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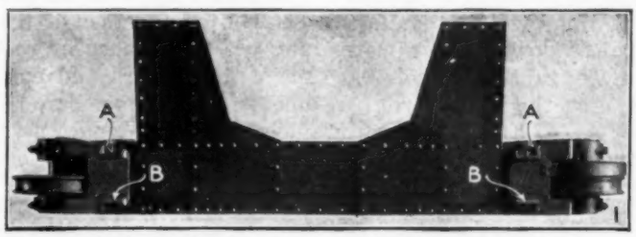
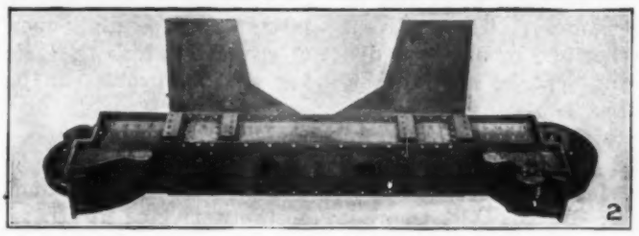
Designing Traveling Cranes with Regard for Safe Operation

Structural Safety to Sustain Loads—Safety Appliances—Locking Switches to Prevent Operation by Unauthorized Persons—Transfer Cranes—Monorail Hoists

By NICOLAAS PRAKKEN
Assistant Manager of Crane Sales, Pawling & Harnischfeger Co.

THE several compensation boards in session on accidents, the factory inspectors working under instructions of their respective industrial commissions and the safety engineers employed by private corporations, have all wielded considerable influence toward having laws enacted, requiring that all machinery used for manufacturing purposes must be suitably protected so that workmen can avoid accidents when working on or about such machines in the regular discharge of their duties. Although no class of machinery has been exempt, the electric overhead traveling crane and the various types of hoisting units have not received safety study until late years, mainly because the crane was working overhead in the charge of the operator and consequently the chance for accident to workmen below was minimized. Such safeguarding features as were formerly provided were incorporated in the design by the manufacturer. Several of the manufacturers of electric overhead traveling cranes have considered the facility of making repairs and getting about on the crane as part considerations of their design.





FIGS. 1 AND 2. TYPICAL END TRUCKS

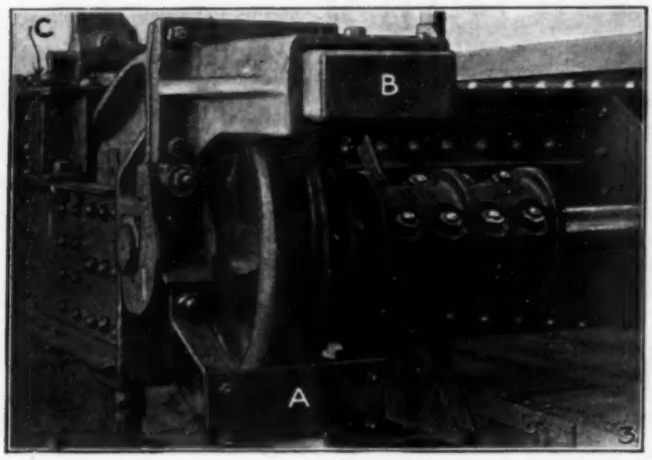
Electric overhead traveling cranes in some form or other are used extensively in nearly all industries where heavy materials must be handled. Such cranes are either operated from a cage attached to the end of the bridge, to the center of the bridge in the case of long spans, or to the trolley, as service demands. Some cranes can be operated from the floor by pendant cords where the service demanded does not require an operator in constant attendance. Many cranes of the floor operated type are in use today in foundries, machine shops, or wherever hoisting service is required. They are usually handled by the operators of the machine tools.

Considerable demand has also been found for the cage controlled monorail hoist and the floor controlled monorail hoist, for the various services outlined above. A cage or floor controlled monorail hoist can be used in connection with transfer cranes which span from runway to runway the same as the standard crane, with the added flexibility that the monorail hoist can run onto the transfer crane in the yard, pick up its burden at any point under the transfer crane runway, lock the transfer crane at the spur connection, and then travel over its I-beam runway and switches, through doors, and onto another transfer crane and deliver the materials to be worked upon. For the same working space in the clear, more headroom is required for the combination of the cage-controlled monorail hoist and transfer crane than for the standard overhead electric traveling crane. The gantry crane is likewise a utility and can be considered better by itself.

In the use of these various types of hoisting units, the mechanical and electrical maintenance is of prime importance and many safety features are now furnished as required by law; many additional safety features are added by request of the purchaser and in many instances the manufacturer provides safety features where neither the law nor the purchaser has requested them. The use of these safety features will be considered with respect to design, construction, and mechanical and electrical maintenance.

The standard overhead electric traveling crane is usually considered as being composed of three units, bridge, trolley and cage. The bridge can be divided into end trucks, girders, bridge machinery and wiring, and each of these divisions will be subdivided in the discussion. The trolley can be divided into trolley sides, girts, gears, pinions, gear cases, limit switches, sheaves, blocks, load and magnetic brakes. The cage is the position from which the crane is controlled and operated, and headroom is the main essential as it usually projects below the top of the crane runway rail anywhere from 6 ft. 6 in. for an inside crane to 10 ft. 4 in. for an outside crane.

The end trucks are that portion of the bridge to which the girders are attached and which contain the bearings and the wheels upon which the crane runs



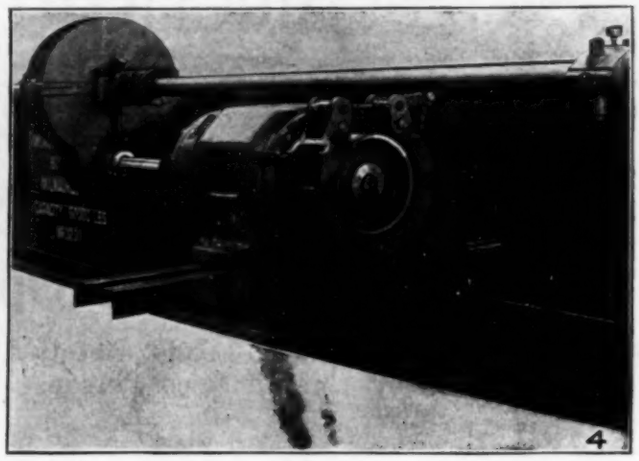


FIG. 3. LUGS AND KEEPER PLATES. FIG. 4. TYPICAL BRIDGE MOTOR WITH FOOT-BRAKE ATTACHMENT

back and forth on the runway. A typical end truck is shown in Figs. 1 and 2. The cast steel M.C.B. housings are first machined and then riveted between the truck channels with top and bottom cover plates. The gusset plates shown hold the girders securely to the end trucks. The M.C.B. bearing seats are then milled in pairs so that both end trucks will be the same length. On the bottom of the M.C.B. bearing castings will be seen lugs at *A* and *B*, Fig. 1, which project down one or more inches below the top of the runway rails. The mission of these lugs is to hold the crane on the runway rail in the event of a wheel breaking. At *A*, Fig. 3, is shown the fender, which fits around the runway rail and functions to brush off a workman's hand should he happen to place it on the rail when working near the runway. Bumpers, as at *B*, should always be used when two or more cranes are on the same runway. They prevent the wheels from jamming together and breaking or distorting the flanges. The bearings can be kept in perfect alignment by placing shims between the M.C.B. journal and its seat, equal in thickness to the wear of the journal. The wear on the journals can be either increased or minimized by having an end truck of a sufficiently large wheel-load part. By wheel-load part is meant the number of pounds each wheel can safely carry. The M.C.B. type of end truck permits removal of the wheels with the minimum amount of effort. The wheels are keyed to the pins, which revolve in journals on both sides. By driving a wedge between truck end and rail the pressure on wheels is released and they can be rolled out after removing the oil boxes. In the pin truck the pin is held in place by keeper plates and the wheels revolve on the pins. No adjustment for alignment can be made in this type of end truck and considerable effort is required to remove the wheels, as they must be lifted up out of the trucks.

The Girders

The two standard forms of girders now in use are the I-beam and channel girders, and the box girders. For machine shop and foundry service I-beam and channel girder spans should not be over 45 ft. for 5-ton capacity, and not over 40 ft. for 10-ton capacity. When spans are longer, the universal box girder should be used. Box girders can be built in any reasonable span and they can be so proportioned that there will practically be no lateral vibration. Irrespective of the type, the girders should be notched or coped around the end trucks and not set on top. In case the girders are merely set on top and bolted to the end trucks, any loosening of the bolts will permit the end trucks to rock. This is not true of coped girders, as they have horizontal bearing angles securely riveted to them. The horizontal bearing angles rest on the end trucks and can be bolted securely to them. Vertical shear angles are likewise provided and match up with vertical angles on the end trucks. The bolting together of these vertical angles eliminates any possible chance of rocking of the end trucks. To make the girders and end trucks still more secure as one structural member, bottom gusset plates are provided under the end trucks, which securely tie the end trucks and girders together on the bottom, keeping the bridge structure square at all times and under all conditions of normal load and travel. Box girders properly constructed are provided with diaphragms at about 3-ft. intervals (depending upon depth of girder and length of span) to which the bridge motor bracket and squaring shaft supports can be fastened. The diaphragms are the inner structure or skeleton of the girder to which the web plates and top and bottom cover plates are riveted. Angles are then run where the web and cover plates join each other and the web and cover plates are securely riveted to these angles. Keeper plates are bolted at the ends of the girders as shown at *C* to keep the trolley rails from creeping.

Bridge Machinery

The bridge machinery is mounted usually on the cage-side girder and consists of the bridge motor with foot brake parts, bridge motor bracket, bridge motor gear case, pinion and gear, squaring shaft and squaring shaft supports, squaring shaft couplings, and foot walks.

A typical bridge motor with foot-brake attachment and motor bracket is shown in Fig. 4. The motor bracket is a structural member, bolted to the girder near the center of span. It is necessary that the girder be here provided with diaphragms as the motor mounted on the bracket is a cantilever beam and the web would buckle were it not reinforced.

The bridge motor gear-case should always be mounted at the center of span. The gear case is a three-part casting with ground joints so gears can run in oil, the middle section being bolted to the face of the web and through the diaphraghms. The bottom casting provides for the removal of the motor pinion and the top cover permits the removal of the motor gear. The motor gear is keyed to a short piece of shaft which revolves in bronze journals on both sides of the gear case. Coup-

lings are provided on each side to transmit the power through the squaring shafts to the gear reductions at the end trucks. By placing the gear case at the center of span the torsional deflection of the shafts on both sides is made more clearly equal, causing the crane to run square. Where the motor bracket is mounted on the girder near one of the end trucks there will be more torsional deflection in the long squaring shaft member and the result is the crane will run out of square. The couplings in common use are the compression and flange types. The compression type is used on moderate capacity cranes and the flange type on the higher capacities. Couplings should be placed at such intervals that the squaring shaft members can be easily handled.

The foot walk should come up against the girder. Foot walks, where heat conditions demand, are made of checkered floor plate, but under normal conditions wood plank suffices. The hand rail is fastened to a toe angle usually 6 in. in height. It provides a support for the workmen on the crane and the toe angle prevents tools and parts being kicked off on workmen working underneath. The foot walk meeting the girder likewise prevents tools and parts from falling to the floor beneath.

The bridge girder conductors can be either wires, bars, or angles. Wires are commonly used, although purchasers, where heat conditions demand them, express a marked preference for bars. The bridge collector wires are held at their ends by strain insulators and where spans of cranes exceed 50 ft. insulated supports should be provided every 30 ft. on which the wires may loosely lie. The bridge collector wires should be kept at least 2½ in. apart and separated at all times a minimum distance of 1½ in. from the surface wired over. In case bars or angles are used as bridge conductors they must be screwed or bolted to insulated supports at such intervals as the properties of the sections require.

The Trolley

A typical top-running trolley is shown in Fig. 5. The trolley sides are of box section and are provided with M.C.B. journals, as in the case of the end trucks, and also with lugs to keep the trolley on the girder rails should a wheel break. Other sections of trolley sides are the I-beam sections but they are not as strong and reliable as the box section.

The girt *A* is a structural member that connects the two trolley sides by bolting. The equalizing sheave, when one is employed, is mounted in the girt, as is also one of the gear cases together with the first reduction. The second and third reductions are on opposite sides of the trolley.

All of the gear-case castings have ground edges so that the surfaces will meet and retain the oil. The trolley drive gear case is shown in Fig. 6 with the front cover removed showing the train of gears. The casting holding the gears is bolted onto the trolley side and with the cover bolted, on the gears are enclosed and run in a continuous bath of oil. Loose covers, as shown at *A*, should be provided on all gear cases for inspection of gears. The enclosing of gears is one of the greatest safety features on the crane and this practice has become universal.

A limit switch is almost as essential as a hoist motor. Its duty is to stop the upward travel of the load block and one of the latest type is shown in Fig. 7. This limit switch consists of two weights. The heavier weight *A* is provided with a loop *B* through which the hoist cable passes to the equalizing sheave and is suspended from a cable *C* fastened to the limit-switch sheave. The limit switch sheave has a weight attached but not so heavy as the suspended weight *A*. Attached to the limit switch sheave shaft is an arm with a keeper that holds the circuit closed to the magnet coil of the contactor. This magnet coil is connected across the line. The contactor is in the main line circuit and is provided with dynamic braking contacts when used in connection with a crane operated by direct current. The lower block is provided with a pan *D* as shown. When the lower block in its upward travel engages the weight it lifts weight *A* permitting the weighted sheave to open the circuit of the magnet coil, thereby opening the main-line motor circuit. As the bridge-motor magnetic brake is in series with both the series field and the motor armature, the magnetic brake coil is de-energized and the friction of the mechanical parts of the brake on the motor pulley brings the armature to rest, thereby arresting the upward travel of the load. The connections in this type of limit are such that with the reversing of the controller to lowering, the suspended weight will automatically reset the limit after the load block has lowered sufficiently to leave the weight suspended by its cable. With this type of switch the cable *C*, to which the weight is attached, can meet any swinging condition of the load block on account of the flexibility of the suspended cable.

A safety cage with doors open is shown in Fig. 8.

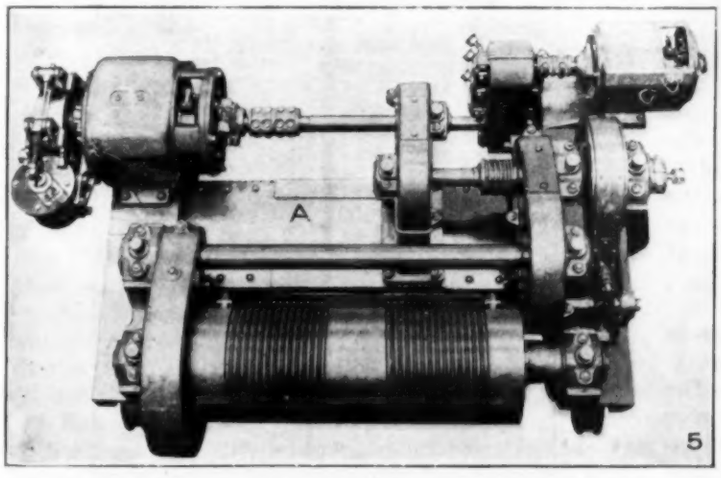


FIG. 5. TROLLEY SHOWING COVERED GEAR CASES

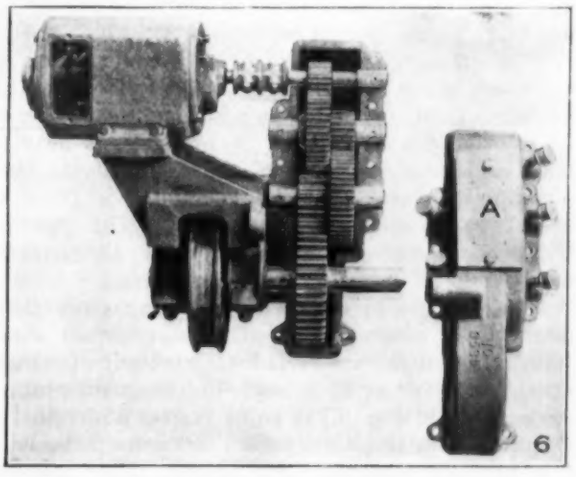


FIG. 6. TROLLEY GEAR-TRAIN AND CASE

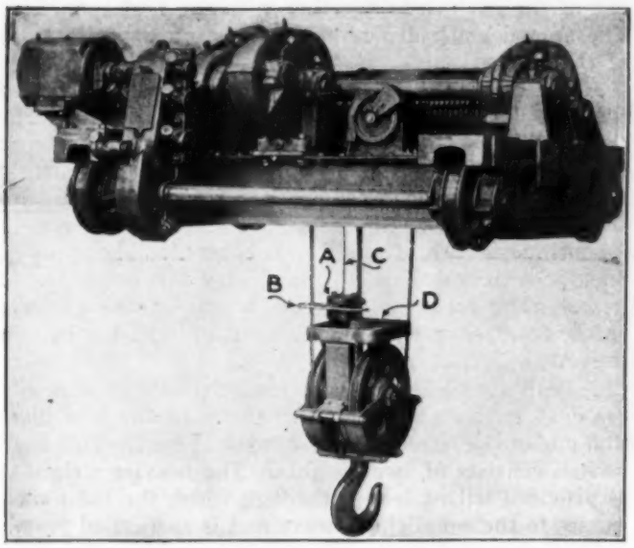


FIG. 7. LIMIT SWITCH FOR THE HOIST

This cage is of the front-lever-stand type. The levers are connected to the controllers by link motion. The controllers are located at rear of cage and enclosed. Doors are provided so workmen can have access to the controllers and for inspection of the switchboard equipment. By having the controllers and switchboard equipment enclosed in a cabinet it is next to impossible for workmen to come in accidental contact with live parts. If the operator wishes to open the switch all he has to do is to pull out the door handle when all the wiring on the crane will be de-energized. Spaces are provided for locks in the door handle. Usually three spaces are required, one for the operator and the other two spaces for workmen. Whenever the operator leaves his cage he should put his lock on this arm. This will prevent unauthorized persons from starting the crane. In case repairmen come onto the crane they likewise should place their locks in their respective spaces and not remove them until their work is finished. The operator's lock should be the last one to be taken off and on closing the switch the crane is ready for service.

This method of locking the main line switch open has advantages because it opens both sides of the line. In many plants plugs are used in one side of the line, operators and repairmen keeping the plugs in their pockets until repair work is completed. This practice is open to objection as there might be a ground on the line and the operator or repairmen could still be shocked.

Where the cage is attached to the trolley there will be main-line wires carrying full potential on the bridge girders and in such cases an additional main-line switch as mentioned above should be provided as near to the main collectors as possible. The front-lever stand is superior to having controllers mounted in front as the operator's vision is not obstructed. The direction in which the levers are thrown indicates the direction of movement.

In all cage controlled cranes having more than one motor, each conductor of each motor circuit should be individually protected by fuses, time limit current breakers, or overload relays controlling line contactors. The cage shown in Fig. 8 has fuses in each individual motor circuit and in the limit-switch contactor with its dynamic braking contacts. Jib cranes, pillar cranes, and floor controlled hoists having a combined motor horsepower of ten or less need not have individual motor protection.

In Fig. 9 is shown the resistance banks *A* mounted under the floor on a sub-floor. Trap doors are provided in the cage floor so these resistances, while isolated, can be made accessible.

The foot brake lever is back of the controller stand and is connected to the brake parts on bridge motor by links.

When cranes are controlled from the floor by pendant cords, the controllers should be of the spring-return type so they will return to the off position the instant the operator releases his hold on the controller ropes. The bridge motors should be provided with magnetic brakes also, so that in case the operator should stumble and fall when walking with his crane he could let go of his hold on the controller ropes and instantly the controllers would go to the off position, opening the motor circuit and the magnetic brake stopping the bridge motor.

The bridge speeds of floor controlled cranes should not be more than 200 ft. per minute.

Fig. 9 also shows a typical cage-controlled monorail hoist which runs on the lower flanges of an I-beam or on T-rails fastened to it. The hoist and cage parts are fastened to the trolleys by king bolts. Hoists of such a type often run as high as 85 or 90 ft. above the ground level, consequently some provision must be made that the machines will not fall if a king bolt should fail. By observing the illustration, safety catches *B* and *C* that ride over the flange of the I-beam, will be seen. These safety catches are always kept clear of the I-beams when running on straight and curved tracks by a link motion attached to the trolleys. The safety catches are free to move laterally and should one or both king bolts fail the safety catches would engage the I-beam and prevent the hoist from falling to the ground.

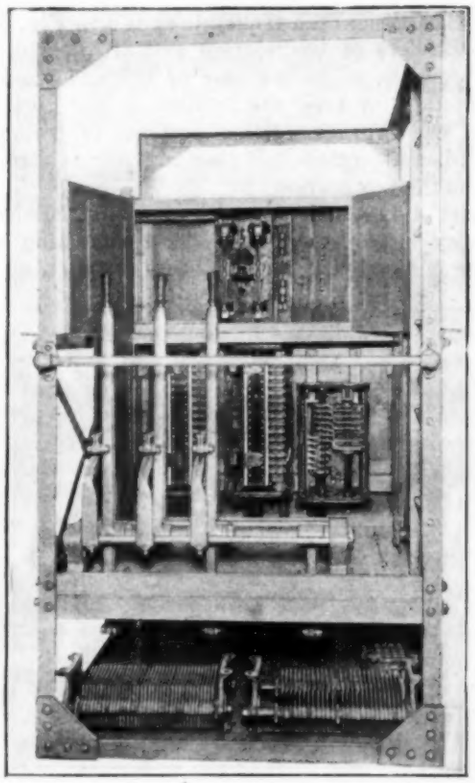
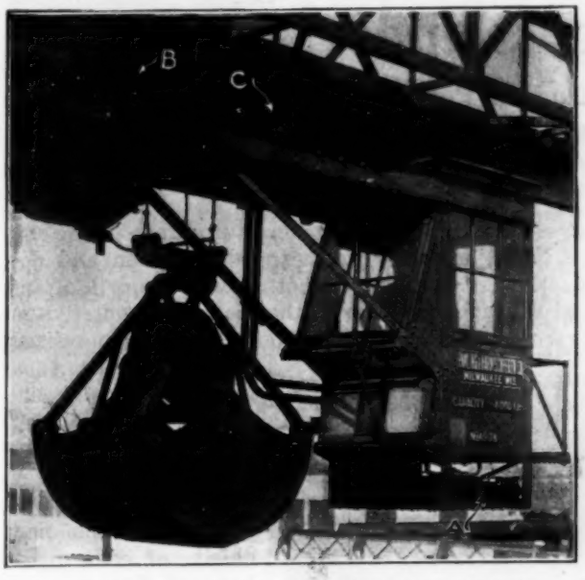


FIG. 8. SAFETY CAGE WITH DOORS OPEN



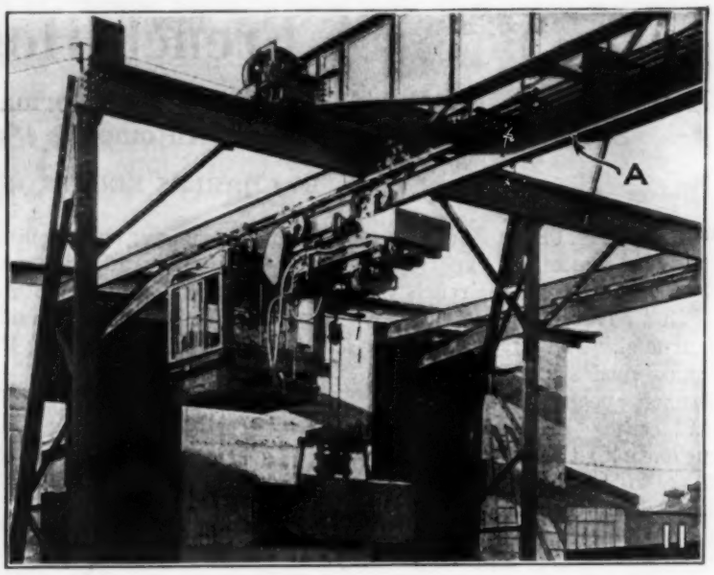


FIG. 9. CAGE CONTROLLED MONORAIL HOIST WITH SAFETY CATCHES OVER THE FLANGES OF THE I-BEAM. FIG 11. A TRANSFER CRANE ON WHICH A MONORAIL HOIST, EITHER CAGE OR FLOOR CONTROLLED, CAN RIDE

This safety catch is very effective and gives the maximum degree of protection at a minimum cost.

Main line switches should be provided in the cage of monorail hoists with spaces for locks the same as covered in cage-controlled cranes. The individual motor protection likewise applies as given in the section devoted to cranes.

Floor-controlled hoists are those operated by pendant cords, and their I-beam runways are usually near the floor. The maximum capacity of the floor-controlled type is usually not over 5 tons. The hoist speed is usually not over 20 ft. and the trolley speed seldom higher than 200 ft. per minute. The service is very intermittent and consequently the maintenance is not as high as on the cage-controlled type.

I-Beam Switches

In Fig. 10 is shown a two-way switch. The direction in which the switch is thrown is the path of travel for the materials the monorail hoist is carrying.

Switches of this type should be baffled so the hoists cannot run off open spur ends. Heavy steel lugs, as at *A*, engage the web of the I-beam, prevent the hoist from running off an open spur or the tongue, for when the switch tongue is thrown halfway there is not sufficient clearance between the I-beam to let the trolley pass through. As the switch is thrown clear over, the lug is fully engaged with the open spur and totally disengaged from the lined-up spur.

A system can contain as many switches as are necessary and a further flexibility is added by the use of the transfer crane.

The Transfer Crane

In Fig. 11 is shown a typical transfer crane installation. The end trucks, bridge motor and bridge motor gear case, and bridge machinery, are the same as that on the standard cage-controlled overhead electric traveling crane. It differs from the standard crane in that it carries an I-beam on which a monorail hoist, either cage or floor controlled, can ride. Transfer cranes when not locked to the spur runway must have ends baffled so the monorail hoist cannot run off the open ends. The baffles are a part of the mechanism that locks the transfer crane securely to the spurs. In the locking process the baffle on the spur as well as on the beam is raised, which permits the monorail hoist to leave the bridge. As the controller for the bridge motor of the transfer crane is installed in the cage of the monorail hoist, the operator is assured that his transfer crane will not be moved while he is delivering material to other parts of the plant. Upon his return he can unlock the crane which will drop his baffles on both the spur and the beam of the crane.

General

A very bad practice is prevalent among users of traveling cranes; namely, the tendency to overload them. This fact becomes more evident when it is realized that some 10-ton cranes offered for sale, weigh the same, span for span, as their competitor's 5-ton cranes. It is obvious that weight when properly placed is a measure

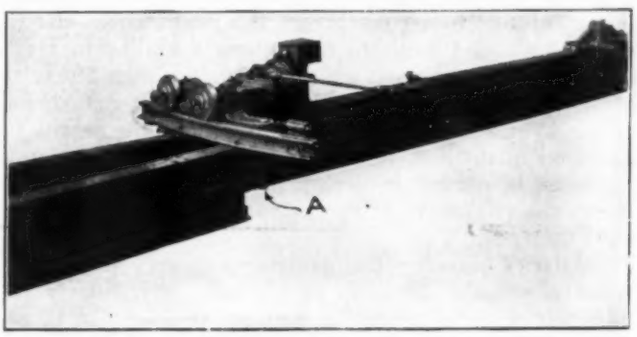


FIG. 10. A TWO-WAY SWITCH. STEEL LUGS PREVENT THE HOIST FROM RUNNING OFF AN OPEN SPUR

of strength and when equipped with motors the crane can be made to perform work in proportion. Therefore the 10-ton crane that weighs the same, span for span, as the 5-ton crane cannot be overloaded to the same extent. The safety features on a crane are essential to protect the operator and the reapirmen, and it is just as essential from a safety point of view, to buy a crane of a recognized weight that will insure a full measure of successful operation with maintenance costs at a minimum.

A French Hog Island

Growth of Industry During the War—Transformation to Peace-Time Production—Bleriot Shipbuilding Plant—Citroen Automobile Plant—France's Marketing Problem

By CHARLES EDGERTON CARPENTER

"WANTED: An able advertising manager, one especially experienced in international trade. Address: French Government, Paris."

This advertisement has not yet appeared in the Paris journals. That it has not is due altogether to the innate modesty of the French people, who still cling in large measure to the belief that to advertise is immodest. Heroic in war, industrious and thrifty in peace, honorable and considerate in both, France has yet to learn that while good deeds ultimately bring their just rewards, a little judicious advertising can be made to expedite them, particularly when trade is dull.

If the world were not so busy with its own affairs and could spare the time to investigate the needs of its neighbors, France might be able to dispense with the services of an advertising manager for a long time to come, relying upon her past reputation for quality and service to bring the patronage she needs. But the world has troubles of its own and, even if they are less pressing than those of France, they are nearer at home and therefore more insistent in their demands for adjustment.

What France needs from the world at large is neither money nor credit, but confidence and faith—confidence in her ability to recover from the devastating effects of the war, and faith in her ultimate ability to meet the obligations imposed upon her by the huge financial drain she has suffered. These desirable commodities of confidence and faith exist throughout the world in generous quantities. Only the wand of the advertising manager is needed to direct them to France, to help her in the vital work of reconstruction which her people have undertaken.

Statistics showing the growing recovery of French industries since the close of the war, particularly regarding exports, are published at frequent intervals by the Ministry of Finance of the French government. They indicate that the foreign trade of France is slowly but surely approaching a state in which the imports of food and raw materials, so necessary to France's industrial recovery, will be offset by the exports of the products of French farms and factories. If this steady growth can be maintained, the day will not be far distant when the unfavorable balance of trade which has weighed heavily against France since 1914, and has largely brought about the onerous depreciation in her currency, will be transferred to the credit side of the ledger.

It is unfortunate that the French statistics, while telling eloquently of the general progress made by France in her recovery from the devastation and demoralization of the war, cannot show the spirit of individual courage and energy that is being contributed by Frenchmen in all industries to the results generalized in the figures. If a few sidelights could be thrown on the brief reports of the Ministry of Finance, they would prove beyond doubt that the new spirit of enterprise born of France's necessities during the war has come to stay, and that it will prove no mean factor in establishing the industrial position of France among nations in the future. There is a great lack of knowledge throughout the world as to what has been accomplished in an industrial way in France since the signing of the armistice. Much has been published in the United States and elsewhere about the industries in the north which were carefully and systematically destroyed by the Germans, and the world in general is familiar with the huge task of reconstruction that has been courageously undertaken by the people of the devastated provinces. Little or nothing, however, has been published to show the magnitude of the industrial reconstruction that has been carried out in those parts of France which were untouched by the invaders, and yet the problems that have been met and overcome have been very close in magnitude to those of the north.

Growth of Industry During War

It must be remembered that before the war France was not a great industrial nation. Her metal-working industries were markedly inferior in importance and diversification to those of England and Germany. As a result, shortly after the beginning of the war France became acutely dependent upon other countries during the period required to equip herself for turning out the vast quantities of material and supplies needed by her armies. The country's needs called for and received a quick response from the latent spirit of enterprise of French manufacturers and metal-workers, and great industries for the manufacture of shells, gun parts and airplanes sprang up magically through the country from the war zone to the Mediterranean. So successfully did these industries meet the demands made upon them that, when our own armies came to France, it was found possible to furnish them a large amount of equipment out of the surplus capacity of French plants.

The armistice confronted these newly created industries with the problems of peace-time existence. Few

establishments, obliged by the ever-growing needs of the war to strain every nerve and muscle to meet the demands of increased production, had been able during the war to study and prepare for their industrial future. The coming of peace, therefore, found them faced with idle machinery, demoralized transportation, organizations highly trained in munitions making but untrained in commercial manufacturing, and with sources of supply thoroughly upset. Had these establishments existed before the war, it would have been a comparatively simple problem to transform them to their pre-war production, although even in this case four years of intensive war activities, coupled with the general industrial demoralization, would have placed serious obstacles in the path. Not all of them, however, particularly the large establishments, possessed the asset of pre-war training in the production of commercial articles; and for these plants the question of future existence carried acute significance.

Location of Plants Important

One of the post-war problems that bore heavily upon the owners of many munitions establishments was that of location. The needs of war are usually separated from economy by a wide margin, and a location that might prove to be suitable for a war factory might mean inefficiency and failure to a commercial enterprise. The war factories that grew like mushrooms throughout France were built with little regard to future convenience from the standpoint of economical production, the problem of future utilization being wholly secondary to the urgency of the moment.

The importance of location, in making plans for commercial manufacturing, became increasingly signficant to French manufacturers during the period immediately following the armistice, when the intricate transportation system, designed and built up almost exclusively to satisfy the needs of the military authorities, was handed back to its civilian executives. Rolling stock was found to be badly scattered and in urgent need of repairs, while the facilities for restoring it to workable condition were found to be totally inadequate in comparison with the amount of work to be done. This condition spelled disaster to manufacturing prospects dependent upon equipment and raw materials, unless, co-incidentally with the development of manufacturing programs and with the training of workmen, means for obtaining a supply of materials could be devised.

Motor Trucks Help Transportation

How efficiently and with what energy and resourcefulness French manufacturers, spurred on by the inspiration given them by the magnitude of their achievements during the war, met and overcame the transportation difficulties is a story in itself. When it became evident that the railways were powerless to cope with the country's needs, motor trucks appeared magically upon all the roads throughout France. Truck factories worked night and day and the thousands of trucks released by the armies were patched up and put into service to relieve the strain on the railroads. Regular truck services were inaugurated, not only between the large cities and towns, but also between France and Belgium. Truck builders, instead of testing their finished chassis on the roads adjacent to their plants, sent them to the ports for fuel and to the mills for steel.

Meanwhile, the stocks of gasoline accumulated during the war when the exchange rates were favorable to France began to show signs of depletion, and prices began to soar. The operation of trucks became a costly undertaking, but by this time the railways had been able to straighten out their kinks and traffic moved freely once more.

Building Ships in Paris

There are many examples in France of the successful utilization of war factories for peaceful purposes in apparent defiance of the economic law of location, but it is doubtful whether a more brilliant example can be found than the transformation of a vast airplane factory into a modern, twentieth-century shipyard—a miniature Hog Island—fifteen minutes ride by automobile from the Place de l'Opera, and a stone's throw from Paris' magnificent park, the Bois de Boulogne.

It is highly improbable that in the ordinary course of events a successful shipbuilder, in looking about for a site for a highly efficient yard in which to build ships in series, would select the city of Paris for his undertaking. With several hundred miles of seacoast, dotted profusely with deep-water ports that afford unusual facilities for shipyards to choose from, no Frenchman planning to build ocean-going ships in pre-war days would have given a serious thought to the city of Paris, 150 miles inland, as a possible location for his project.

When Louis Bleriot, the first to cross the English Channel in an airplane, thereby setting a new fashion in cross-channel travel and demolishing England's confidence in her feeling of splendid isolation, looked down from his plane upon the ships that dotted the channel, it is fairly certain that no premonition of his future career as a shipbuilder was revealed to him.

Bleriot Plane Factory

The spirit of enterprise, however, that carried Bleriot from France to England through the air had a stronger foundation than the mere desire for adventure. When the importance of the airplane in warfare had made itself apparent in the early days of the war and the call for planes became insistent and imperative, Bleriot threw himself heart and soul into the task of supplying the army's needs. He built and equipped a huge plant for the manufacture of planes, and to his efforts was due in no small measure the success of the French in the air. As fast as profits came to him he reinvested them in increased capacity for making planes, although he knew that the end of the war would sound the deathknell to the manufacture of airplanes for a long period of time.

The armistice had scarcely brought the wheels of industry in France to a full stop, when this indefatigable aviator-manufacturer began to cast about for a means to employ his modern plant and the thousands of workmen he had gathered together. Here the problem of location intervened. Situated in the middle of a great center of population with all the attendant drawbacks of transportation and fuel, with a factory designed for the manufacture of articles of great bulk but little weight, it became manifestly difficult to settle upon a suitable product to make. The structure of the buildings precluded the selection of heavy material, since no mechanical means of handling it had been provided for in their form of construction. On the other hand, the extensive use of wood and fabrics in the manufacture of planes pointed to the desirability of undertaking work in which similar materials formed the main foundation.

It was at this juncture that the crying need for ships for fishing purposes to replace those sunk by German submarines and to provide an increased source of food supply became acute. Bleriot decided to build ships and to build them as no one in France had dared build

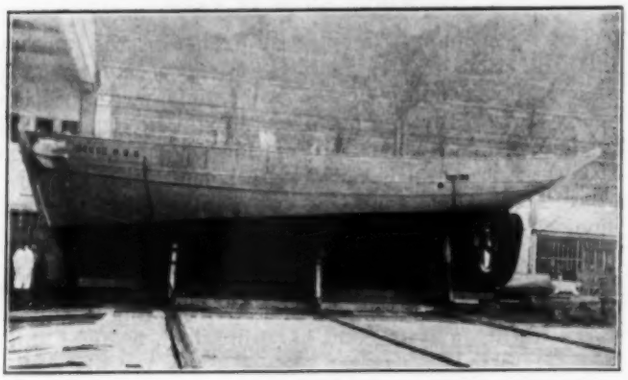


FIG. 1. COMPLETED HULL OF WOODEN FISHING BOAT

them before; namely, wholesale. He secured the services of an experienced and active young shipbuilder from the coast, to whom he confided his ambitions, with the injunction to organize the plant without loss of time, to order the necessary equipment and to train the men in the proposed new method of operation. While this task was being drawn into shape Bleriot went out to solicit orders, which he obtained in the form of a contract from the French Government Merchant Marine for seventy ships at a cost of approximately three hundred thousand francs each.

Contract Secured in Spite of Objections

It must not be supposed that the securing by the aviator-shipbuilder of so handsome a contract from the Merchant Marine was not attended by numerous difficulties. It is characteristic of the man that the contract was forthcoming in a brief space of time, notwithstanding the violent objections to the project that were raised in seafaring circles. To the officials of the Merchant Marine the proposal of an aviator to build ocean-going trawlers of one hundred tons displacement in the heart of the city of Paris verged so closely on the ridiculous that for a time it was not taken seriously. When, however, it became clear that Bleriot's proposal was based upon a determination to carry out his plan, negotiations with him were begun. Whereupon, the seacoast shipbuilders, learning of the affair, raised loud cries of protest against so unheard-of a project. These objections, however, were as chaff in comparison with the material difficulties that beset the successful carrying out of the undertaking.

A Year of Perseverance

Almost the last available foot of lumber in France had been used to feed the armies of France, America and Britain. The construction of wooden ships on a vast quantity basis meant primarily an assured supply of suitable timber, while the trees needed to furnish it stood still uncut in the forests and the machinery to convert them into the necessary shapes had not been built. Furthermore, the demoralization of the transportation system was such as to throw the gloomiest doubt on the possibility of gathering together in a crowded metropolis, several hundred miles distant from the forests, enough material to realize so extensive a program. A year of uninterrupted perseverance solved the material difficulties, and within eighteen months from the date of the armistice the Bleriot shipyard on the banks of the Seine had set a new fashion in shipbuilding in France.

Type of Boat Built

In the eyes of Americans familiar with the prodigious efforts of Hog Island and other American yards during the war, the Bleriot yard is not a vast accomplishment, but as an example of the new spirit of industrial France it is significant and compelling. The ships, which are now being turned out at the rate of one per week, have an overall length of seventy-six feet, a beam of twenty-one feet and a draught of twelve feet. They have a displacement of one hundred tons and are driven by eighty-horsepower semi-Diesel engines of two or four cylinders. A completed hull is shown in Fig. 1. Built throughout of oak, only the keel strips, cross braces and bolts are of iron. The oak is exclusively of French growth, the logs being brought to the lumber yard at the plant, where highly developed modern machinery saws them to the proper shapes. The planks and beams are then steamed, to extract the sap, and dried, preparatory to the final operations.

The fashioning of the shapes is done by ordinary carpenters, little or no skilled shipyard labor being em-

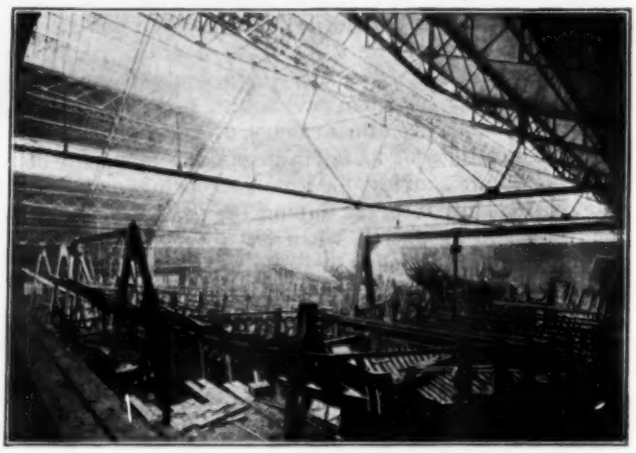


FIG. 2. TEN HULLS IN THE COURSE OF CONSTRUCTION IN THE MAIN HALL

ployed, except for the assembling of the hulls. Accurate templets of the parts to be made are given to the carpenters, who are merely required to duplicate the dimensions and shapes of the templets, a comparatively simple operation. Each templet bears the number of the part, this being duplicated on the shape and insuring easy identification in the final task of bolting the shapes in place on the hull.

The Assembling Hall

The large assembling hall is one of the wonders of munitions-factory installations in France. It measures 283 x 233 ft. and the doorway is 133 ft. in width. A good idea of the building can be obtained from the headpiece of this article, showing the main launching doorway. The entire floor of the hall is laid with tiles that would be a credit to the bathrooms of a modern apartment house. There is sufficient accommodation in the hall for the simultaneous construction of ten hulls, as shown by Fig. 2, the keels being laid upon heavy greased ways placed upon the tiles in such manner that the completed hulls can be hauled by powerful winches to the doorway of the launching dock.

Not the least of the difficulties encountered in the organization of the building program was the lack of a suitable means of launching the completed hulls. The shipyard is located on a broad thoroughfare, known as the Quai du General Gallieni, and which skirts the river Seine. The permanent obstructing of the thoroughfare being forbidden, it became necessary to improvise mechanical means for lifting the hulls and lowering them into the water. A slight incline leads from the floor of the hall to the door. On this incline, rail carriers receive the finished hulls and transport them across the thoroughfare to the dock, where they are picked up in slings, as can be seen in Fig. 3, by a giant crane, which swings outward over the river and deposits them gently in the water. Here the masts are set, the engines installed and the ships prepared for the sea.

Conversion of the Citroen Plant

Another noteworthy example of the successful transformation of a great munitions factory into a modern manufacturing establishment is that of the great shell plant, in Paris, of Andre Citroen. The Citroen plant at the close of the war was producing daily fifty thousand shells and employing ten thousand hands. Situated almost at the base of the Eiffel Tower, in the heart of the city, this huge establishment attracted world-wide attention as one of the wonders of France at war. Scarcely a day passed that distinguished foreigners, crowned heads, statesmen and military representatives did not visit it to see the magnitude of France's industrial effort. It was one of the first of the great French munitions plants to utilize female labor on a large scale, more than half the employees being women. Women operated the huge forging presses that drew the shells from solid bars of steel, operated the lathes that turned the shells to size, inspected the finished work and packed it for shipment.

The armistice stopped the wheels of the Citroen plant, but not for long. In an incredibly brief space of time the machinery was rearranged, raw materials began to arrive, and in a few months the new Citroen automobile made its bow to the public. It, too, set a new fashion in France, a fashion born of the war. An intensive advertising campaign announced that the Citroen plant had adopted American practice and was prepared to accept orders for twenty thousand cars, all for delivery within a year. The public responded generously, orders poured in at the rate of several hundred a day. The price was low, the design attractive, but above all the product was French.

The appearance of the new car in ever-growing numbers in the cities and towns throughout France was the signal for caustic criticism by the skeptics who disapproved of the adoption of American methods in France. It was pointed out that quantity-built cars were all right for the Americans who were accustomed to things quickly and cheaply made, but that in France only the hand-finished product would suit the fastidious taste of motor-car buyers. The answer to the critics was the swelling stream of cars that flowed from the doors of the Citroen factory. Another munitions plant had successfully bridged the gap between war and peace.

FIG. 3. THE LAUNCHING CRANE LOWERING A HULL

Success Not Universal

From the striking examples of success that have attended the transformation of certain war-built establishments in France, it must not be inferred that progress in the reorganization of industries has been universally conspicuous.

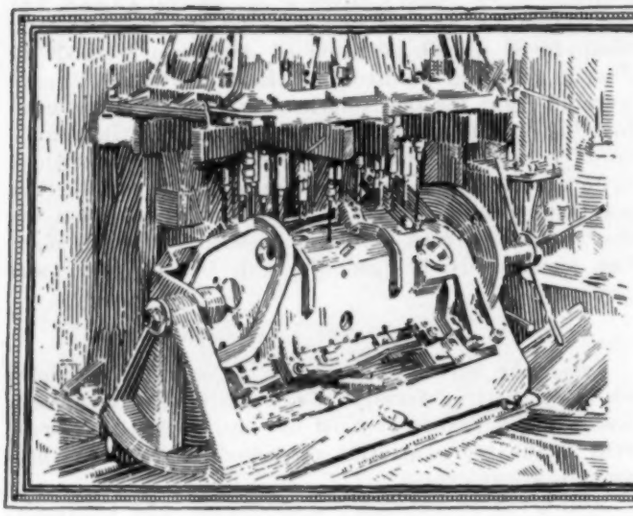
Ability to manufacture economically and efficiently, while important and necessary to success, is unavailing unless proportionate means of distribution are at hand. The problem of distribution during the war did not exist. A single customer, the Government, bought the output of French factories and placed it in the hands of the consumers, the armies. Salesmen were superfluous and sales departments existed only as receiving points for the Government's orders. The salesmen were the first to be called to the colors and the last to return. Many of them failed to return, and herein lay one of the most serious problems of reconstruction that French producers were called upon to solve.

In pre-war days, France was not a large exporter of metallurgical products. She possessed little or no commercial organization for the introduction of her manufactures into foreign countries. Her industries were comparatively small. Highly developed home selling organizations, as known in the United States, were rare. How, then, to market the output of mass-production methods was the question that faced the owners of factories which the war had lifted to the ranks of the big business undertakings.

France's Final Reconstruction Problem

This question has yet to be answered in France. In spite of the encouraging growth of the French export trade, it can truthfully be said that this growth is less the result of French selling initiative abroad than the desire of the outside world to buy certain French specialties. The war practically excluded from the markets of the world the silks, tapestries, linens, automobiles, wines and bronzes of France, and buyers who have hungered for them for years have been eager to replenish their stocks. The favorable rate of exchange prevailing since the summer of 1919 has been an added attraction to those countries whose currency is less inflated than the French, and orders from abroad have come unsolicited.

It cannot be expected, however, that this condition will continue indefinitely, for France as a producer of luxuries must ultimately give way to France as a producer of necessities. The return to France of the iron ore of Lorraine, the richest known deposits outside of the United States, entails marketing obligations on a world scale that will severely tax the capacity of the country to meet; and it remains to be seen how skillfully the manufacturers of France will solve this final reconstruction problem.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Drill Jig Design—Value of Analysis—Location of Rough and Finished Work—Correct and Incorrect Location and Clamping

THERE are a number of elementary points which need to be considered in the design of drill jigs. The progressive designer considers these points almost unconsciously when he starts to design a jig. The beginner, however, and the man who has had only a small amount of experience in jig design must continually think of the things which he must look out for in his design. In taking up these various points they will be considered in elementary and graphical forms in order to make the *principles* clear and readily understandable. After the tool designer obtains a clear knowledge of the fundamentals which underlie the design of jigs and fixtures he will be able to analyze things for himself and he will know absolutely whether or not the principles on which he is working are correct.

Value of Analysis

Let us digress for a moment to take up the matter of analyzing a problem before attempting to solve it. Every piece of work which is to be tooled must be very carefully looked over before any tooling is started, in order that a clear understanding of its functions and the importance of the various surfaces may be understood. In analyzing the processes considerable thought must be given to the machine tools which are to be used in the manufacture. If the work has been laid out by the tool engineer, there will be a list of operations which the tool designer can consult so that he will know just what machine tools are to be used for each operation. A complete analysis of the tool problems connected with the work should embrace also the types of jigs and fixtures most suitable, and should consider the location of the fins, ribs or drafts, as well as any irregularities, in order that location points may be selected which will not be subject to variations caused by rough grinding, filing and clipping. It is always advisable for the tool designer to make such a thorough study of the piece of work which he is about to tool that he can carry it in his mind without having to question the relations of various portions to each other. After this analysis has been made he should be ready to start his first jig or fixture.

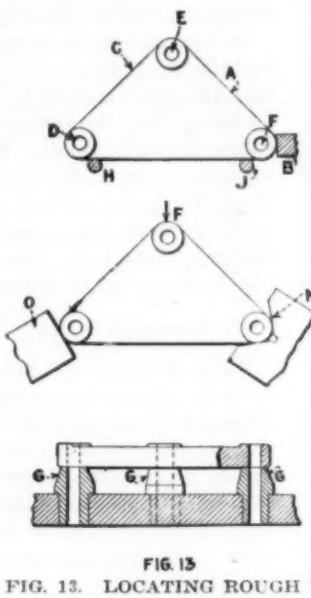


FIG. 13

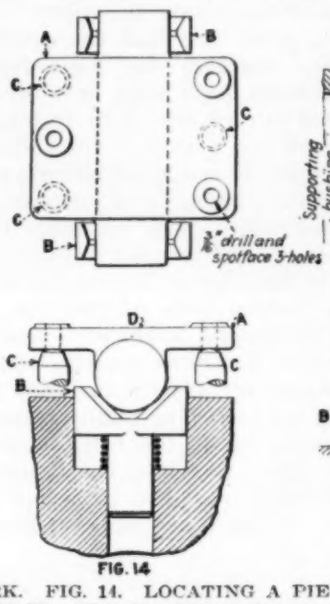


FIG. 14

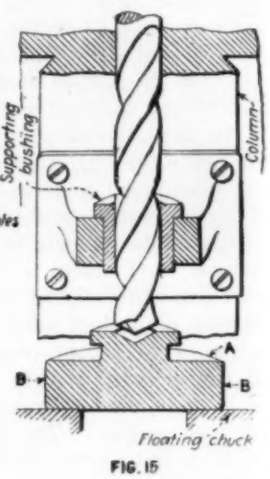


FIG. 15

FIG. 13. LOCATING ROUGH WORK. FIG. 14. LOCATING A PIECE OF ROUGH WORK HAVING A HUB CAST ON IT. FIG. 15. FORGING OF GEAR BLANK WITH HOLE COUNTERSUNK

When designing a jig the following points must always be considered: the method of locating the work so that it will be machined in a uniform manner; the clearance between the jig body and the work; suitable provision for clearance; chip clearance; accessibility in setting up and removing the work; distortion in clamping, etc. Various points in connection with these matters will be discussed in detail.

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In locating a piece of work in a jig when no other operation has been performed on it previously, the greatest care must be taken to select such points for locating that inequalities in the casting or forging will not cause the work to be thrown out of line in such a way that subsequent operations will not give accurate results. The work may be a rough casting or forging and while the forging may be smaller and more accurate than the casting there is always the matter of draft to be considered. It is advisable wherever possible for the tool designer to obtain a sample casting or forging from which to work. Not only does this make the tool problem more simple, but at the same time it enables him to note where irregularities are likely to be found on the work and to guard against putting a locating point so that it will come in contact with some irregular surface. In a forging, if it happens to be a complicated one, there may be an excessive quantity of metal on certain parts, on account of forging conditions. Unless the tool designer has a forging drawing, a "lead," or a rough forging, he may not be able to make sufficient allowance in his jig or fixture to take care of the excess metal mentioned.

A fundamental principle in tool design is, that a rough casting or forging must not be supported on more than three fixed points. Let us consider the work shown at *A* in Fig. 13, which is a rough casting of triangular shape to be drilled in the three corners where the bosses are located. Now in setting up this work in a jig we shall apply the principles mentioned above and use three points as a support. These three points will come directly under the three holes *D*, *E* and *F* and they may be made in the form of bushings as illustrated at *G* in the lower part of the figure. Now let us consider that we have located the work in one plane but we must also make sure of its location in the other direction. Probably the easiest way to locate it is by means of the pins *H* and *J* and by placing a square stud or block at *B*. In clamping the work, pressure can be applied at one point in the direction *C* as indicated by the arrow, so that this clamp will force the work over against the pins *H*, *J* and *B* and hold it there positively. The other method of locating the same piece is shown in the center of the illustration. In this case one corner of the work is located in a V-block *M* and the other corner comes against the angular block *O*. Pressure is applied at the point *F*. It is understood that the method of setting up on the three bushings is the same in either case.

Locating a Piece of Rough Work Having a Hub Cast On It

Referring to Fig. 14, another piece of work is shown which has a rough hub cast on it and extending beyond the flange of the work *A*. Now this piece is also a rough casting and in order to obtain a true relation between the hub and the rest of the casting it is necessary to use the hub in setting up the work. By referring to the upper figure it will be seen that we do not depart from the three point method of setting up on the pins indicated at *C*. At the same time however the necessity for considering the hub makes it advisable to provide a means for locating it on the spring V-blocks *B*. By applying pressure at *D* the work will seat itself on the three points *C* and will also locate in the spring V-blocks. In connection with the V-block mentioned it is well to note that these should be made with a so-called "knife-edge."

Very frequently rough forgings are made with the locations of drilled holes indicated by a countersunk spot. Fig. 15 shows a gear blank with the center hole countersunk in this manner. In cases of this kind it

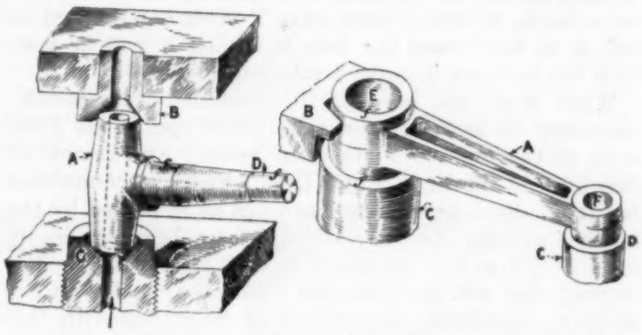
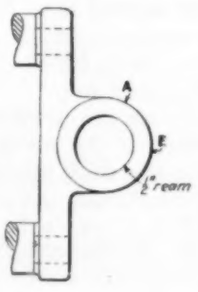


FIG. 16. INCORRECT METHOD OF LOCATING A FORGING FOR DRILLING. FIG. 17. LOCATION OF A CONNECTING-ROD FORGING

is common practice to set the work up and hold it by the outside *B* in a floating chuck. When this is done the chuck is placed on a drilling machine and the drill centers itself in the countersunk hole, thus making a jig unnecessary. It is sometimes found advisable where very much of this work is to be handled and when the drilled hole is long, to provide a supplementary bushing, supported on the column of the drilling machine in order to steady the drill and prevent it from "wabbling." The manner in which this is accomplished is clearly shown in the illustration.

Another condition sometimes found in machining a rough forging is indicated in Fig. 16. In this case steering knuckle *A* is the part in question and it is necessary to drill through the center of the long hub indicated. One end of the hub is located in the cup bushing *B* while the other end seats itself in the screw bushing *C*. Now this particular case is given as an example of a method which should not be used. In the first place a screw bushing is not very good practice because it is not sufficiently accurate and it is likely to become clogged with chips and in the second place the method shown is dependent for its accuracy on the regularity of the two ends which seat themselves in the bushing. If these ends are not uniform the work will not be true in the



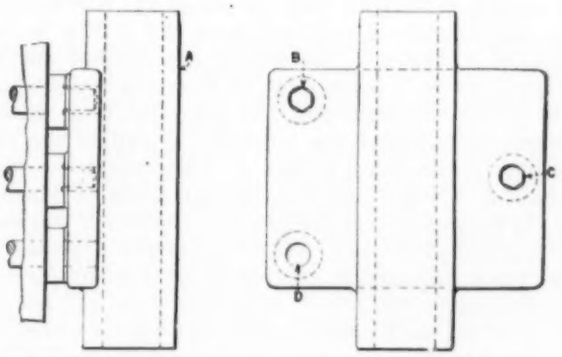


FIG. 18. LOCATION OF FINISHED WORK

bushing and as a consequence there will be a variation in the relation of the hole to the arm *D*, such that the latter may be out of line and will not clean up in the subsequent operation of turning the portions marked *f*. A much better way to locate a forging of this sort would be to locate it with a knife-edge V-block at each end of hub *A* so that when the hole is drilled it will be true with the hub and in correct relation to the portion *D*.

When work has been partly machined it is usually necessary to locate it for subsequent operations from some of the finished surfaces or holes. An example of this kind is shown in Fig. 17, in which the connecting rod *A* has been previously machined as indicated by the finished marks. As these surfaces have been previously finished and as it is necessary to drill the holes *E* and *F* so that they will be true with each other and with the surfaces machined, the work must be set up with this point in mind. By allowing it to rest on the bushings *CC* the relation desired can be readily obtained. It is however, necessary to obtain a location for the hole *E* and at the same time make sure that this location will not disturb the seat on the two bushings *CC*. This can be done by using a V-block as shown at *B* having a bearing which touches the hub above the parting line of the forging. When pressure is applied at *D* the effect will be to throw the hub over into the V-block and at the same time the angularity on the hub will tend to draw it down on to the bushing *C*. It is not usually considered good practice to drill and ream the hole *E* and the small hole *F* in the same operation and it is customary to locate the hole *F* from the previously machined hole *E* and to do the work in another jig.

Fig. 18 shows another method of locating finished work. It will be noted that this piece is the same as that shown in Fig. 14 and the operation to be done in this case is the drilling of the long hole in the hub *A*. The holes *B*, *C*, and *D* have been drilled and reamed in a previous operation. It will be remembered that we were careful to locate the work for the first drilling by means of the long hub and as a consequence we can now use the holes drilled in the previous operation for locating the piece when drilling the long hub. By setting the work up on pins at *B* and *C* we obtain our alignment and the stud *D* simply acts as a support. If there were to be other operations on this piece it would be advisable to use the holes *B* and *C* to locate from through all the subsequent operations.

Fig. 19 shows another example of a method of locating a piece of finished work of which the surface *f* has been machined in a previous operation. The work is shown at *A* and it is located on the finished surfaces indicated as it is necessary to keep the holes square with the finished surfaces. At the same time we wish to make certain that the holes are drilled in the right relation to the hubs *E* and *F*. Therefore we use a V-block *B*, slightly undercut at an angle of about 10 deg., in which to locate the hub *F*. The hub *E* will swing over against the block *C* which is also slightly undercut. Now when pressure is applied in an angular direction as indicated by the arrow at *D*, the work will not only seat itself on the finished surface but will be forced over into the V-block *B* and against the angular block *C* thus assuring a positive and accurate location.

There is a very important point which should always be considered in the location of holes in two adjacent pieces, when these holes pass through both pieces and are used as rivet or bolt holes to hold the two pieces together. An example of this kind is shown in Fig. 20. In this case the two disks *A* and *B* shown in the first part of the illustration, are held together by rivets passing through the holes *C* and *D*. It is evident then that these holes must be in alignment. Now let us assume that the work *B* is placed in the jig so that it is drilled from the side *E* and in the direction indicated by the arrow. After this is done it is evident that the drill may "run" a trifle so that the holes may take a slightly angular direction as indicated. Now if the upper pieces *A* were to be drilled from the side *F* and in the direction indicated by the arrow there is a possibility that these drilled holes might also run out a trifle. The result would be that when an attempt was made to assemble the two parts *A* and *B* they would be out of alignment and it would be impossible to put the rivets in place to hold the two parts together.

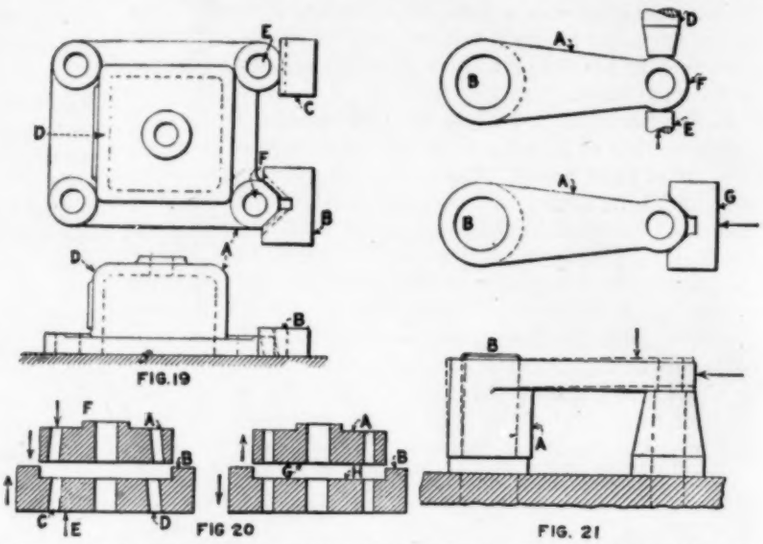


FIG. 19. LOCATION OF A FINISHED CASTING. FIG. 20. CORRECT AND INCORRECT METHODS OF DRILLING HOLES IN ADJACENT PARTS. FIG. 21. CORRECT AND INCORRECT LOCATION AND CLAMPING

Assuming that both parts *A* and *B* as shown again in the other part of the illustration, are drilled in each case from the sides *G* and *H* which are adjacent to each other, then it is evident that at the points where the drill starts in each case the holes will coincide.

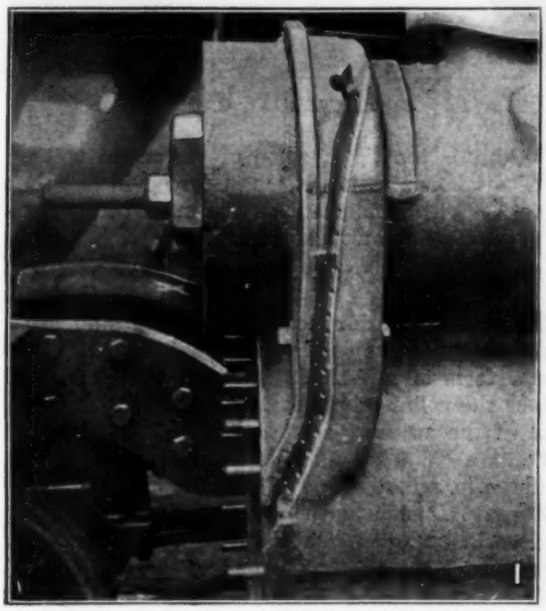
The matter of distortion must be considered when locating and clamping any piece of work. Several examples of this kind are shown in Fig. 21. Referring to the upper illustration the lever *A* is located on a stud *B* and is clamped at the end *F* by means of the clamp screw *E* which throws the work over against the stud *D*. Now it will be seen that when pressure is applied in the direction indicated by the arrow it cannot cause distortion or change of shape in any way. On the other hand referring to the illustration below if the work *A* were to be located on a stud *B* with a sliding V-block *G* used as a locater and clamper, it is evident that the pressure applied in the direction indicated by the arrow might very easily tend to distort the work as shown by the dotted lines in the lower portion of the illustration. These are points which are frequently neglected by a tool designer.

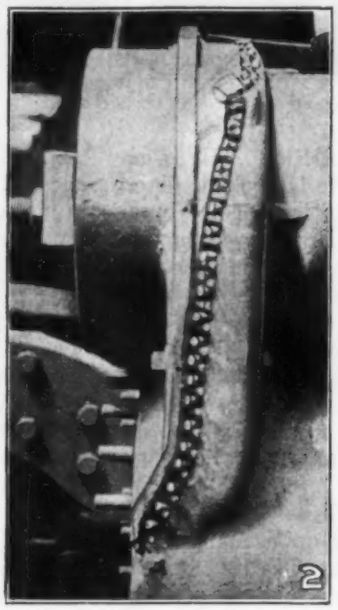
Railroad Shop Notes

Repairing Broken Cylinders by Electric Welding—Gaging Driving Box Brasses—Gage for Setting Half Cranks on Walschaert Valve Gears—Link Milling Attachment

By S. ASHTON HAND
Associate Editor, *American Machinist*

ONE of the interesting things to be seen in the railroad shop of today is the repairing of broken parts by electric welding. In a large railroad shop in the Pittsburgh district the writer recently saw some remarkable examples of welding broken cylinders. Cylinders are among the most costly parts to replace and shops will go to almost any length to repair and keep in service cylinders so badly damaged that before the days of electric welding would have been scrapped.





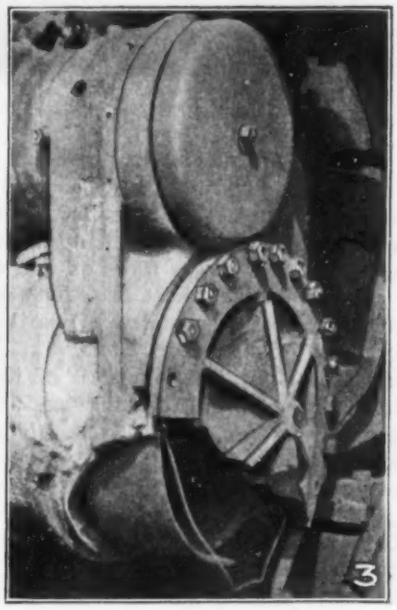
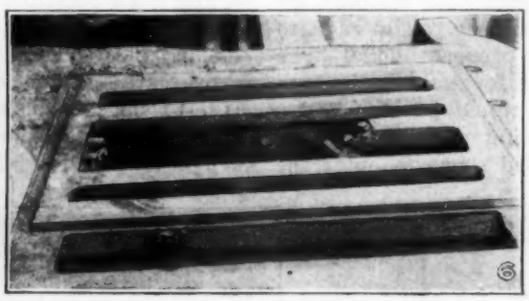


FIG. 1. CRACKED CYLINDER WITH V-GROOVE CHIPPED, DRILLED AND TAPPED FOR STUDS. FIG. 2. SAME CYLINDER WITH STUDS IN PLACE. FIG. 3. A BADLY BROKEN CYLINDER

Much ingenuity has been developed in the methods of making cylinder repairs as will be evidenced by an inspection of Figs. 1 to 6. In Fig. 1 the web between the cylinder and valve chamber has been cracked and the cylinder itself sustained some injury.

The crack has been closed as much as possible by clamps held by a heavy bolt through the cylinder. With the crack as a guide a V-shaped trough was chipped its entire length and the sides drilled and tapped for the insertion of studs. Fig. 2 shows the studs in place. The crack was welded by the electric process, using wire electrodes and the application was continued until the trough was entirely filled.

Fig. 3 illustrates a cylinder so badly broken that it would seem to be almost beyond repair. The part broken out was in several fragments and could not be used as a patch so a pattern was made from which a piece of the shape of the break was cast. The inside of the casting was machined to the same radius as that of the cylinder and the final fitting of the edges completed by chisel and file.



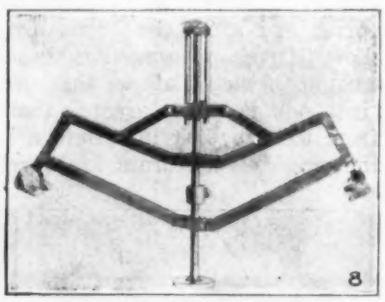


FIG. 4. A COMPLETED PATCH FIG. 6. AN UNUSUAL BREAK FIG. 8. THE INTERNAL GAGE

With the patch clamped in place a groove was chipped, drilled and studded as in the previous case and the welding completed in the usual manner. Fig. 4 shows a patch welded in a cylinder that had been broken nearly in the same way as the one shown in Fig. 3. Both of these cylinders are now doing good service.

Another bad break that was successfully repaired may be seen in Fig. 5.

FIG. 5. ANOTHER BAD BREAK

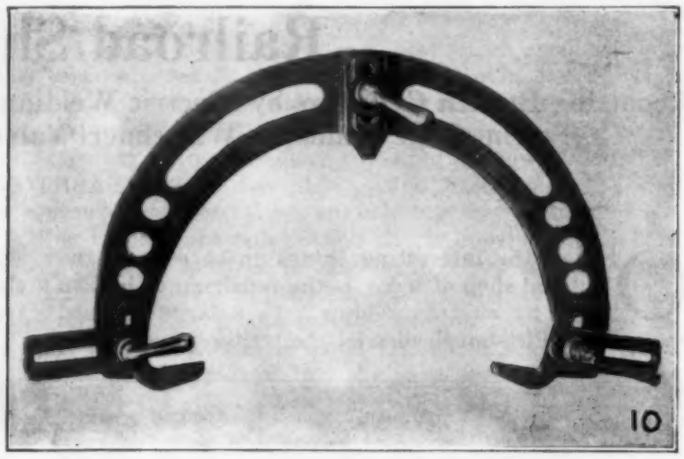


FIG. 10. THE EXTERNAL GAGE

A very unusual break is shown in Fig.6. Here one of the ribs dividing the exhaust ports is broken. There was no chance to fit a patch, so the edges of the break were studded and after being built up by welding, the whole valve seat was faced off and made as good as new.

Crown brasses must fit tightly in the driving boxes, and not being a complete circle the fit cannot be made by size of diameter alone, but, while the diameter must be right, the tightness of the fit depends on the horns *A* (Fig. 7) bearing against the recesses *B* in the driving box. It will be readily seen that a fit of this kind is not the easiest one to make unless special gages are at hand.

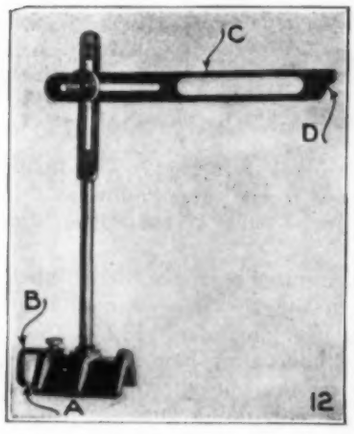
In machining the outside of the brass, the ends are first trued and it is then clamped on a mandrel between heavy washers and turned in a lathe. As the brass is slightly more than a half circle, calipers can be used for this part of the fit. To fit the horns *A* to the recesses *B* is another matter and to get the first measurement the gage shown in Fig. 8 is used in the manner illustrated in Fig. 9. This measurement is then transferred to the gage shown in Fig. 10 and the gage applied to the crown brass as illustrated in Fig. 11; here it is used as a template for scribing the horns, and after the horns are planed, as a gage to show if the planing has been properly done. The amount of metal left on the horns for making the fit a tight one is much greater than would be supposed—from 0.02 to 0.03 in. Before being pressed in place, the edges of the brass are bevelled so as to enter the box. If the fit is too tight, some of the metal will be sheared off the horns as the brass is forced in but that is not a matter of any moment as the main thing is to have the brass as tight a fit as possible.

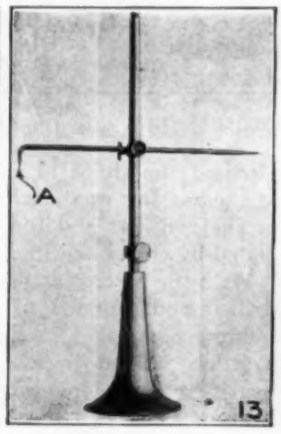
Some Other Gages

Fig. 12 shows a gage for locating the flanges on truck wheels in relation to the collar on the axle journal. The base, in the form of a V-block, is placed on the journal and against the collar where it is confined by bringing the end *A* of the adjustable hooked-piece *B* against the end of the axle. When the arm *C* is set in both height and extension in accordance with the dimensions of the wheel, the part *D* shows whether the flange has been properly located and also whether its contour is correct.

A gage for setting the half crank of the Walschaert valve gear is shown in Fig. 13. The base is held against the end of the driving axle and is centrally positioned by a spring plunger pin in the interior entering the countersink in the axle. With the pointer *A* set to the off-center distance called for by the design of the engine, the half crank can be swung around and the gage revolved until the center in the pin and the pointer *A* of the gage coincide, when the keyway can be located and marked.

Some things, such as wedges and shoes for driving boxes, are gotten out by manufacturing methods. Fig. 14 shows a planer with fixtures running the full length of the table and arranged for holding gangs of wedges and shoes while being planed. The screws in the





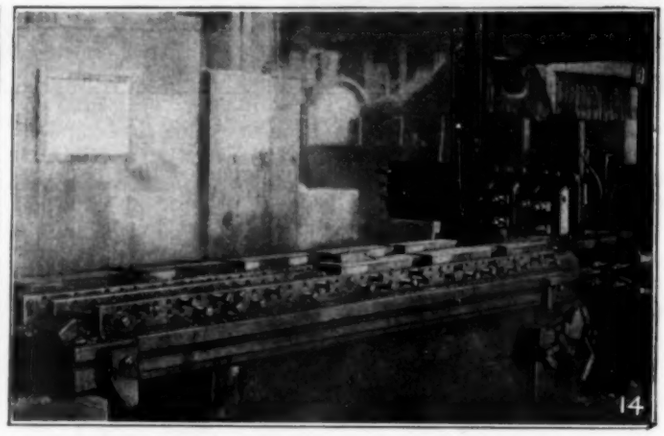


FIG. 12. FLANGE GAGE FOR TRUCK WHEEL. FIG. 13. GAGE FOR SETTING HALF CRANK ON WALSCHAERT VALVE MOTION. FIG. 14. PLANING SHOES AND WEDGES IN GANGS

upper part of the fixtures are for holding the work, while the ones below operate wedges for leveling and adjusting it for height. These wedges, together with the center block used in conjunction with them, are shown in Figs. 15*a* and 15*b*. In Fig. 15*a* they are shown in the relative position occupied by them when in the fixture, while in Fig. 15*b* they are shown on their sides with the wedges on top of the center block so as to bring to view the shape of the holes for the ends of the adjusting screws. The adjusting screws are ball-ended, the ball part fitting into the circular parts of the holes so that the screws will move the wedges either in or out according to the direction in which they are turned.

Eccentrics are bored on a vertical boring mill as shown in Fig. 16. The auxiliary table on which the eccentric is mounted has two pins which fit in blind holes in the under part of the eccentric and locate it for the boring operation. The two locating holes are laid out on the eccentric by a sheet-metal templet. It will be noticed that the clamping bolts are slotted in the upper ends and that taper keys are used for tightening the clamp on the eccentric.

Side rods are milled in gangs of four on a planer-

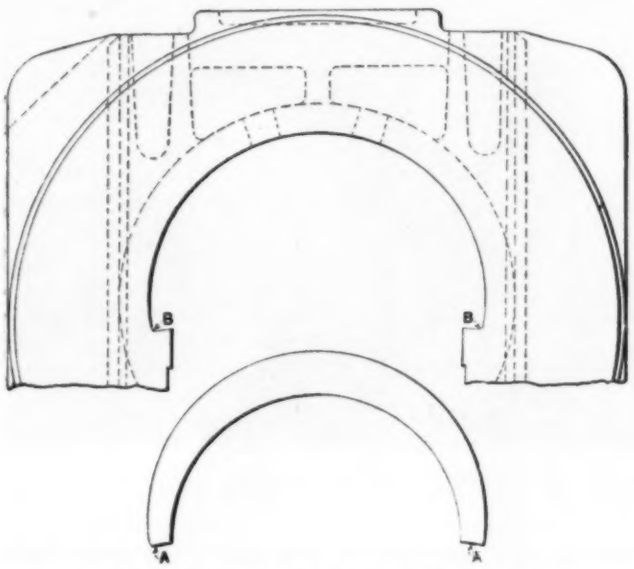


FIG. 7. DRIVING BOX AND CROWN BRASS

type milling machine and the ends are rounded in gangs of two on a vertical milling machine fitted with a revolving table. The latter operation is shown in Fig. 17. An inserted tooth milling cutter is used and it will be seen that the arbor is prevented from springing by being held at its lower end in the bearing at the end of the arm *A* which is rigidly supported by the column of the machine.

In some shops cylinder bushings or liners are first turned to fit the cylinder bores and the boring done after the liners have been shrunk in place. In the shop under consideration it is the practice to bore the liners to standard cylinder sizes and hold them in stock so that when needed, a liner can be fitted to any engine by turning the outside to fit the cylinder.

This method makes for quicker repairs as it takes less time to do the boring in a lathe or horizontal boring machine, than to set up a portable apparatus and bore the liner after it is in the cylinder, and besides half the machine work is done in advance because a rough liner would have to be both turned and bored after the engine was in the shop.

Fig. 18 shows a liner being bored in a lathe, a cradle

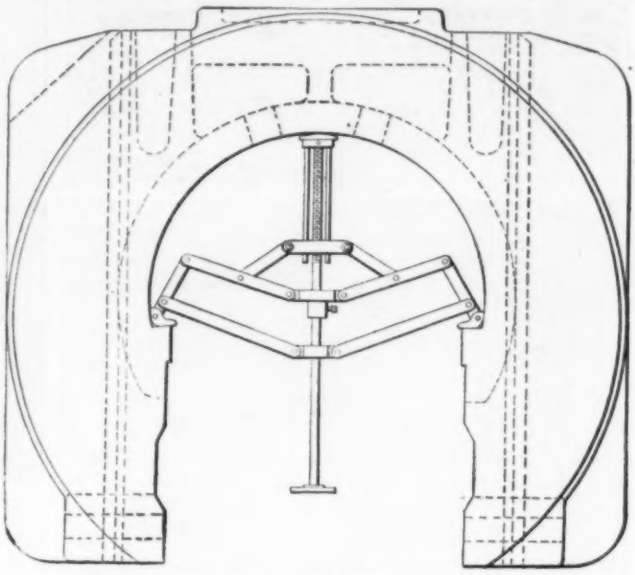


FIG. 9. INTERNAL GAGE IN DRIVING BOX

and clamps of flat bar-iron being used to hold it during the operation. For turning, the liners are held on mandrels provided with collars to fit the counterbored ends.

In shrinking in liners, the cylinders are heated by coke fires built in and around them. The allowance for the shrink fit is about $\frac{1}{32}$ inch.

The Old Reliable Slotting Machine

In spite of the advent of the miling machine, the old "slotter" still holds sway in the railroad shop, for on what other machine could the work on the rod strap, as shown in Fig. 19, be more conveniently done?

Links for valve motions are usually planed by the use of a radius bar pivoted at a distance from the work, determined by the radius of the link. Fig. 20 illustrates a home-made attachment to a vertical milling machine for milling links. Two tables, *A* and *B*, are mounted on the circular table of the milling machine. Table *A* is clamped in position while table *B* is pivoted to it and carries the link to be milled. The attachment at the left is built wholly of bar iron and carries a radius bar

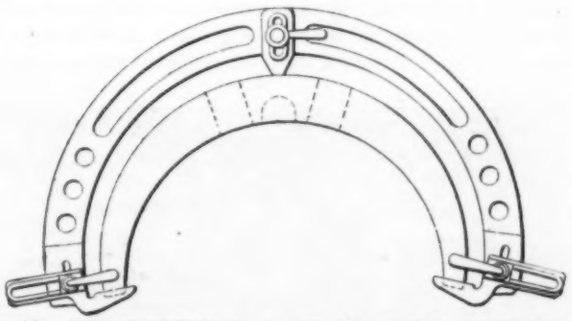
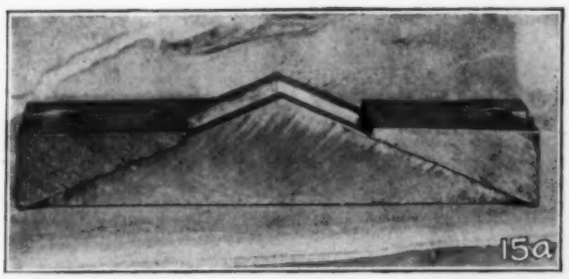
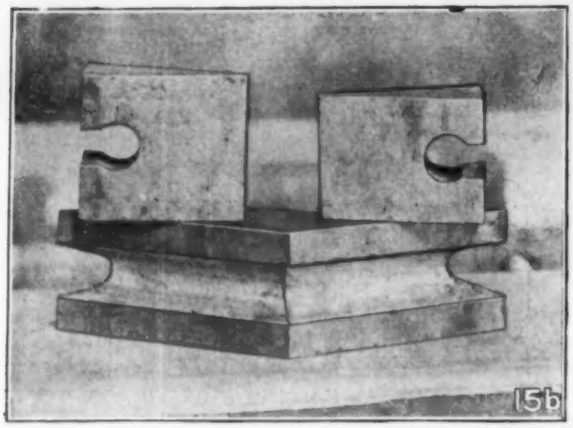
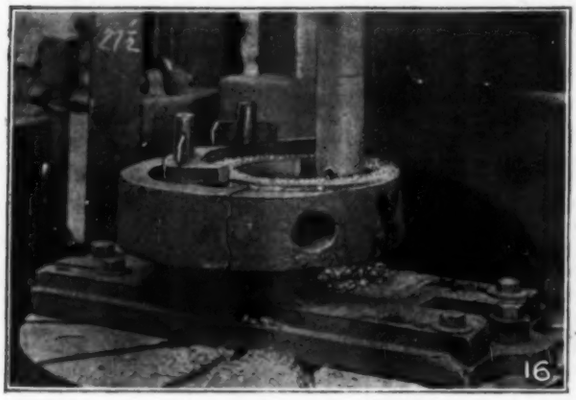


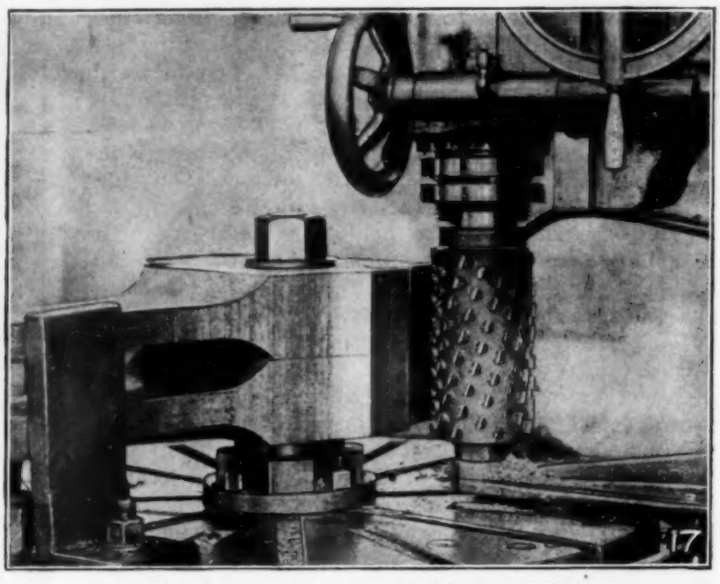
FIG. 11. THE EXTERNAL GAGE ON THE CROWN BRASS

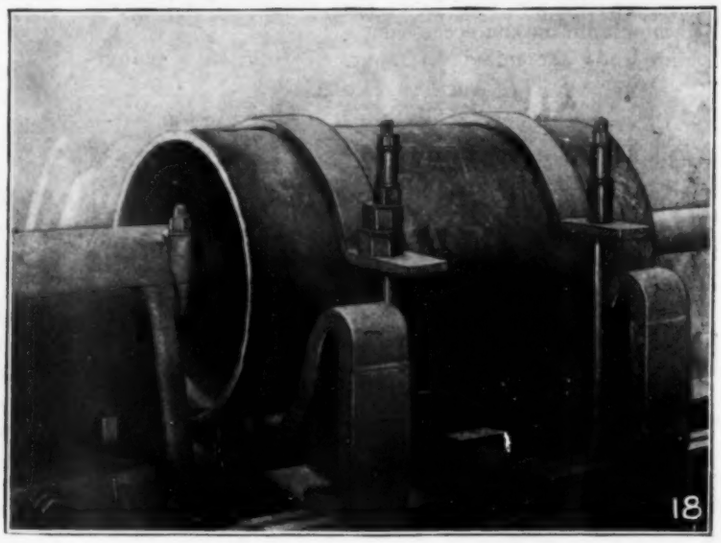
C pivoted near one end and guided by the quadrant *D* by which it can be adjusted to varying angles. Table *B* is slidably connected to the under side of the radius bar by the extension *E*. It will be readily understood that with the radius bar set to the proper angle and the cross-feed of the machine in action, the link mounted











FIGS. 15a AND 15b. TAPER BLOCKS FOR LEVELING SHOES AND WEDGES. FIG. 16. BORING ECCENTRICS. FIG. 17. MILLING ENDS OF SIDE RODS. FIG. 18. BORING A CYLINDER LINER

on the pivoted table will be made to move in the path of an arc.

Cleaning boiler flues is one of the most disagreeable jobs in the shop and many are the devices that have been arranged for doing the work. One device is shown in Fig. 21. Here a sheet-metal tank has been sunk below the floor and provided with loose endless chains passing over sprockets at each side. The chains pass completely around the tank, the upper parts hanging down in the middle in "bights." The sprockets on one side of the tank are revolved by an electric motor, giving motion both to the chains and the sprockets on the opposite side. The flues are placed in the "bights" of the chains and enough water put into the tank to

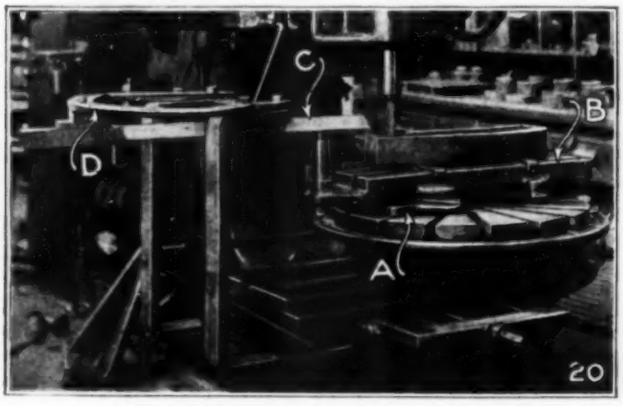


FIG. 20. A LINK MILLING ATTACHMENT

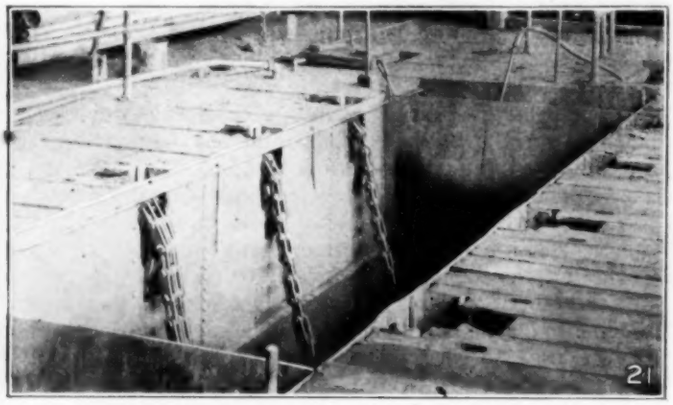


FIG. 21. TANK FOR CLEANING BOILER FLUES

cover them. When the motor is started the flues are tumbled one upon the other, loosening and washing off the scale. A set of flues can be completely cleaned in this device in about 7 hours.

The Apprentice School

A school for apprentices is held daily from 7 to 9 a.m. in a class room on the shop gallery. There are about seventy-five apprentices in the shop who attend school in

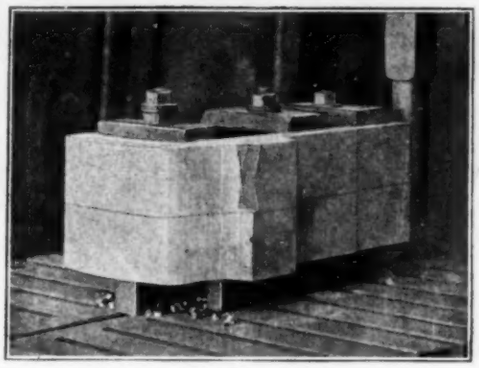


FIG. 19. MACHINING A ROD STRAP

classes of 25, giving each class two sessions per week. At one of the sessions the instruction is evenly divided between drawing and mathetmatics, while the following session is entirely devoted to mathematics. The writer was privileged to be present at one of the sessions and was very much impressed by the earnest endeavor of the boys and their strict attention to the instructor's directions.

What Is a First-Class Machinist?

By James Vose

Browsing among some back issues of the *American Machinist* brought up the irresistible impulse to make some comments on the good fare provided by a number of your contributors.

It appears to me that with regard to the query "What is a first-class machinist?", again referred to on page 858, Vol. 53, a quite broad-minded attitude will need to be adopted in order to get an approach to the real answer. Much depends on the manner and the circumstances under which men are employed. For instance, I have had men under me whom it was a pleasure to employ on lathe work. They were quick, deft and possessed of an innate aptness for keeping tools sharp and voluntarily finishing their jobs with those little nuances which intimate to the competent observer that the workman has a natural sense of the fitness of things. And yet they might be but sparsely endowed with initiative or desire to expand themselves beyond the kind of work they had, more or less fortuitously, become engaged in.

On the other hand I have equally satisfactorily handled men who would never quite reach the top notch as regards finish, but by their instinctive grasp on the requirements, and their versatility, could take hold of any job reasonably within their line and carry it through with a minimum of uncertainty to the management as to a satisfactory outcome. Also they could be depended on to make a good showing if placed under unusual circumstances without immediate guidance or instructions.

I have in mind at the moment one who could take charge of a works stores, run the boiler and engine, etc., cut a creditable figure on lathes and standard machine tools, benchwork, general outdoor millwrighting and erecting, and write to headquarters an intelligent and intelligible report as to the conditions to be met and progress on the job. He could also act as foreman if required. Such men, however, are not to be expected to do their best work if governed by cast-iron or petty regulations.

Another variant of such a man will, as a matter of course, tackle a full round of general and wheelwright blacksmithing, operate a lathe and general shop tools, do a certain range of sheet-metal work and work of rather rough steel construction and boilermaking character and carry out dismantling, re-erection, and comprehensive general repairs to a distinctly hefty building-contractors plant, often under discouraging out-of-doors conditions. But, quite likely, by many critics he would not be considered a "good machinist."

Again, where regular quantity or mass production is in evidence, men who are not conspicuously bright, who only are fairly good workmen in a rather narrow sphere but are cheerful, willing and consistently regular in attendance might gladly be conceded by some harassed foremen or superintendents to be what are called "good machinists."

Touching on the remarks on "Efficient Pattern Making" on page 858, Vol. 53, an experience of mine may shed some light on how the provision of outlets for good points may cancel, or make unnecessary consideration of bad points. Being shown over the works by the superintendent of a widely known engineering shop in Rugby, a wood carving machine was pointed out to me in the patternmaking shop. It was explained that a similar machine had been seen doing good work in a cabinet making works and, it was thought, it could hardly fail to be useful in a large pattern shop. However, one of the men, who, by reason of his good hand craftsmanship and capacity for "efficient pattern making" on the improvisation lines outlined on page 858, carried considerable influence in the shop, had a perverted kink in his makeup which impelled him to belittle the possibilities of wood-working machinery. His attitude led to the carving machine being comparatively ignored.

Congenial Work and Its Results

One young fellow, who had nothing like the same measure of patternmaking and foundry work lore as the first mentioned man, was noticed by the superintendent to have a sneaking regard for not only the carving machine but for any other woodworking or allied machinery. The upshot was that the re-actionary man was assigned to a regular post in the foundry on a congenial job assisting the molders in the setting of intricate cores and co-operating with the foundry generally in the way of simplifying methods of molding and, in general, making the most economical and versatile use of existing and new patterns. Meanwhile, the man who liked machinery felt free to indulge his bent and used the carving machine freely, bringing out unsuspected good uses of it, and gradually so changed the shop's attitude that it became a quite accepted and appreciated item in the equipment. Now, to my mind, each of these two patternmakers might fairly be classed as an efficient craftsman, but to those for the look out only for bad points, each of them might fail to qualify for places in that category.

Programs of Apprenticeship and Special Training In Representative Corporations

By J. V. L. Morris

XII—The Packard Motor Car Co., Detroit, Mich.

Apprentices Trained in School and Shop—Technical Graduates Given Comprehensive Course — Truck Salesmen Instructed by Lecture Course

THE most significant educational work of the Packard Motor Car Co. is its apprentice training, in which 122 young men are enrolled. There are in addition, however, some excellent advanced training courses for technical graduates in which twenty-one men are enrolled, and in the truck department there is a salesman's school through which about twenty are continually passing, the length of the course being three weeks.

All of the 122 apprentices are in the machinists' trade, except seven patternmakers and six electricians. All, however, take the same supplementary course of about four and one-half hours per week of mathematics and mechanical drawing. A class of apprentices is shown at drawing work in Fig. 53. All students are also required to attend the city night school, when it is in session. The course is three years in length and during the third year the best students are selected for transfer to the toolmaker's shop and for tool designing. The number, of course, depends on the demands of those departments. The trial period is for only two weeks.

FIG. 53. APPRENTICES IN DRAWING CLASS

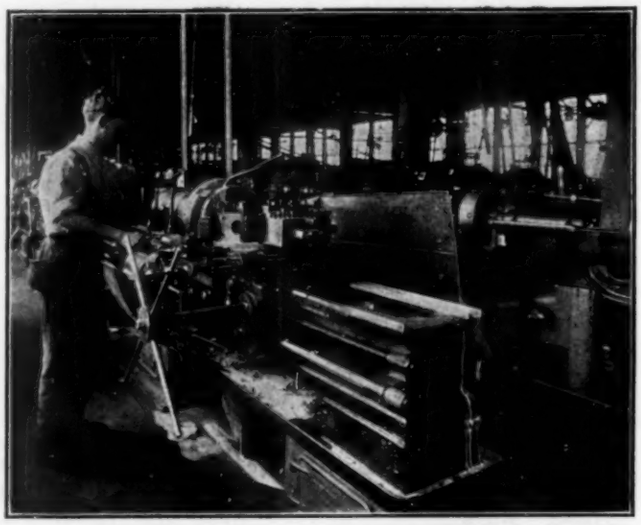


FIG. 54. RUNNING A TURRET LATHE IN THE SHOP

The apprentices are in the charge of a supervisor, who is a technical graduate with extended shop experience. He has authority to arrange transfers of apprentices about the shops to give variety of experience at all types of machines. He is assisted in the school instruction by a technical graduate for the drafting classes. The scope of the work is broad, Fig. 54 showing an apprentice at a turret lathe, and Fig. 55 another one at work as a body designer.

In the indenture which all apprentices must sign, together with their parents, the apprentices are required to deposit $25 as a guarantee of good faith to complete the apprentice course. This fee is returned at the expiration of the apprenticeship, together with a $100 bonus. The rates of pay for the six 6-month periods are, respectively: 30, 34, 38, 42, 46, and 50 cents per hour. "Graduates of the Detroit high schools, well recommended by the principal, may have their term of apprenticeship shortened at the discretion of the company."

Some twenty-one technical college graduates are being transferred about the plant in a two-year course designed to give them the requisite experience for ultimate positions as executives, or as engineers. Their pay starts at 40 cents an hour. They have a fifty-hour week, the same as the regular production force.

The outline of the training programs follows. There are now fifteen in the course of executives.

OUTLINE OF ADVANCED TRAINING COURSE FOR EXECUTIVES

Weeks		Class of Work
21		Machine shop practice
	4	(a) Preliminary instructions
	3	(b) Drill press
	4	(c) Milling machine
	6	(d) Lathe
	4	(e) Gear cutting and grinding
4		Forge
	1	(a) Stamping
	1	(b) Drop forge
	2	(c) Tools and dies
4		Foundry
	1	(a) Wood pattern making
	1	(b) Metal pattern making
	2	(c) Moulding
4		Inspection
	1	(a) Rough and finish
	1	(b) Gages and tools
	2	(c) Materials testing and chem. lab.
3		Hardening and Tempering
6		Assembling
	3	(a) Rear axle and transmission
	3	(b) Clutch and motor
4		Testing motor and dynamometer
4		Employment
4		Factory routine
6		Purchasing
8		Production
6		Stock methods
8		Engineering
8		Time study
4		Industrial organization and shop management
10		Electives
104		

NOTE. — APPLICANT MUST BE A COLLEGE GRADUATE OR EQUIVALENT.

OUTLINE OF ADVANCED TRAINING COURSE FOR MECHANICAL MEN

Weeks		Class of Work
21		Machine Shop Practice
	4	(a) Preliminary instructions
	3	(b) Drill press
	4	(c) Milling machine
	6	(d) Lathe
	4	(e) Gear cutting and grinding
4		Forge
	1	(a) Stamping
	1	(b) Drop forge
	2	(c) Tools and dies
4		Foundry
	1	(a) Wood and metal pattern
	3	(b) Moulding
6		Inspection
	3	(a) Rough and finish
	3	(b) Gages and tools
3		H rdening and tempering
6		Assembling
	3	(a) Rear axle and transmission
	3	(b) Clutch and motor
10		Machine Repair
24		General Tool Room
	4	(a) Tool repair
	6	(b) Set-up work
	4	(c) Tool grinder
	10	(d) Jigs and fixtures
26		Engineering and designing
	8	(a) Tool design
	8	(b) Time study and routing
	10	(c) Mechanical engineering
104		

NOTE.—APPLICANT MUST BE A MECHANICAL ENGINEERING GRADUATE OR EQUIVALENT.

Five of the graduates are taking the mechanical engineer's course. Fig. 56 shows one at work on a gear-hobbing machine.

TRUCK SALES SCHOOL

The course in the sales school is now only three weeks in length, but it is filled with the best instruction that the company can provide through the co-operation of engineers and department chiefs. It was started as a five-week course, was later reduced to four weeks, and is now being tried with a length of three weeks. Ordinarily, about twenty men are in attendance, sent in by the company's sales offices and distributors, who

FIG. 55. APPRENTICE AT WORK AS A BODY DESIGNER

pay the student's expenses, amounting to $250 to $500 per man.

The course has been carefully laid out as a study of the car's mechanism, of selling methods, and of the competitive points to be met in selling. It is, however, planned to be broader than a mere training course in

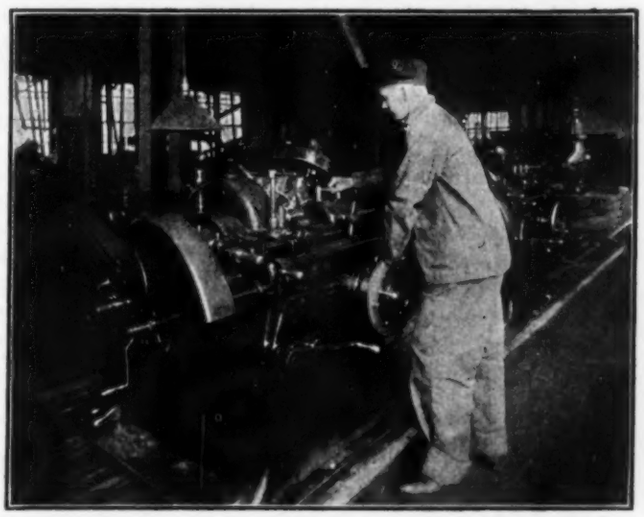


FIG. 56. SHOP WORK ON A GEAR-HOBBING MACHINE

the effective selling of the company's truck, as there are introduced some lectures which should go toward making transportation engineers of the students. We find such lecture topics as: Transportation's Influence Upon Civilization, and How It Has Made the World Smaller; Importance of Correct Specifications; The Coal Industry; The Milk Industry; Professional Haulage.

Design of Helical Springs

Importance of and Factors Entering Into the "Material Index"—Determination of the Torsional Modulus of Elasticity—Control of Unit Fiber Stress

By JOSEPH KAYE WOOD
Engineer, Western Electric Co., Inc., A. T. & T. Co.

IN A recent article by the writer covering the design of small helical springs, an important relation between the "Spring Criterion" and the "Material Index," as given by formula (1), was shown to be applicable to helical spring design in which any size of wire or rod material is used. Formula (1), given below, states that the spring criterion must be less than the material index in order that a spring as designed by the ordinary deflection formula shall be safe for the maximum load applied. The spring criterion includes all the dimensions of the spring, while the material index includes the quantities depending on the properties of the material used.

This article will consider the variations in the different quantities symbolized in this formula which are liable to occur in the making of a helical spring from any size of wire or rod material. It will also outline a method by which these various quantities may be controlled to within definite limits by the designer, and which method, while observing the theoretical laws of spring design, will also be consistent with the standard commercial practice. Only wire or rod of circular cross-section will be considered.

$$\text{Spring Criterion, } \frac{h-H}{H} \div \left(\frac{D}{d}\right)^2 < \underbrace{\frac{\pi S}{G}}_{\text{Material Index}}, \quad (1)$$

1. *The Material Index,* $\frac{\pi S}{G}$. This is by far the most important and doubtful part of the above expression from the standpoint of controlling the various factors in spring design, as the dimensional quantities in the spring criterion are held within satisfactory commercial limits without much difficulty. We will first consider G, the modulus of elasticity for torsion in pounds per square inch, and secondly S, the maximum safe fiber stress for torsion in pounds per square inch.

From the ordinary deflection formula it will be noted that G varies directly as the applied loads and inversely as the deflections. An increase of, say, 1,000,000 lb. per square inch in the value of G for steel, which is generally understood to be equal to about 12,000,000 lb. per square inch, would cause a variation of 8 per cent in the applied load, provided that all other factors remained constant. It would also decrease the allowable safe deflection by 8 per cent, provided that S and $\frac{D}{d}$ remained constant, as may be seen from inspection of formula (1). It is quite obvious, therefore, that a correct value of G should be ascertained if any degree of accuracy is desired. There are four different methods by which the value of G may be determined.

Determination of G

(*a*) *Direct Method*—This method is applicable only to rods and wire of large diameter and consists in noting the loads necessary to produce different angular deflections in a definite length of material. By substituting the average values of these measured quantities in formula (2), which is the definition of G symbolically, the value of G is obtained.

$$G = S_t \div \frac{\theta}{L} = 583 \times \frac{PLR}{d^4\theta^\circ}, \quad (2)$$

where P = load in pounds (below the elastic limit) applied at a lever distance of R, d = diameter of material in inches, L = length in inches, and θ the angle of twist in degrees.

(*b*) *Ordinary Deflection Formula Method*—This formula, which is derived from the previous formula, is applicable to wire and rod material of any size and it, no doubt, gives the most accurate value of G. Any size of spring is made up, within safe limits, and the diameter of the material, outside diameter of spring, and the solid or free length are carefully measured and recorded. Pressures and deflections are then measured; and by substituting all these quantities in the deflection formula (3), G is computed.

$$G = \frac{8PD^3H}{d^3(h-H)}, \quad (3)$$

where H = solid length, and h the length corresponding to the load P.

Where accurate springs are required in fairly large quantities, the value of G for any one run of material should be determined in this way, because it represents the value of G for the actual coiled spring after all mechanical and heat-treatment is completed.

(*c*) *Torsional-Pendulum Method*—With this method the modulus G is determined by fastening at one end a piece of material of a measured length and radius, and suspending from the other end a weight whose moment of inertia is determinant. Then, by twisting the material about its axis through any amplitude, the period of oscillation is determined. Mean values of these various quantities are then substituted in the following formula:

$$G = \frac{2\pi I L}{t^2 r^4}, \quad (4)$$

where I = the moment of inertia of the weight, L and r the length and radius of the material whose G is sought, and t the time of one oscillation. This method is only practical for material of small radius, such as music wire, because from the formula it can be seen that for large values of r the time t would be extremely small, unless an extremely heavy weight were used. The derivation of this formula may be seen at the end of this article.

(*d*) *Elongation Method*—This method is perhaps the most practical method for material having a diameter greater than 0.05 in., it being easily adapted for imposing commercial requirements on the raw material. A sample of the material of known length is submitted to a testing laboratory for a determination of the modulus

of elasticity for tension E; in which pressure-deflection curves are plotted, showing the "elastic limit" point. Curves are also plotted on the same coordinate paper showing the reduction in diameter of the material for each applied load. From this data, the factor of lateral contraction λ for the material is first determined, and then by substituting this value λ and the modulus E in the following formula, the value of the modulus G is determined:

$$G = \frac{E}{2(1+\lambda)}, \qquad (5)$$

where λ is equal to the ratio of the contraction in diameter of the material per unit of length to the elongation per unit of length ϵ. This formula is also derived at the end of the article.

The Fiber Stress

The value of S, which is the maximum safe fiber stress in pounds per square inch, should be somewhat below the elastic limit of the material in question, varying with the condition of service, although the factor of safety for springs need not be as high as for more rigid mechanical structures. Although accuracy in spring design, considered according to the ordinary deflection formula and special formula (1), does not depend upon an *exact* value of S so much as it does with the value of G, yet heat and chemical influences affect the value of S considerably and do not affect G to an appreciable extent. Therefore, it will also be important to know the elastic limit of the material when in the state it will be as a finished spring, in order that the maximum safe fiber stress will not be exceeded, or according to formula (1) that the material index will not be exceeded by the spring criterion. In view of this, the material which is submitted to the testing laboratory for an elongation test should be brought to the same condition, metallographically speaking, as it will be in as a finished spring. Then, about 50 to 60 per cent of the value of the elastic limit for tension will be equal to the elastic limit for torsion. It is also important that the material have as high an ultimate strength as can possibly be obtained, because this will insure a high ultimate torsional strength, the latter being determined by the number of twists through 360 deg. a material will stand before breaking.

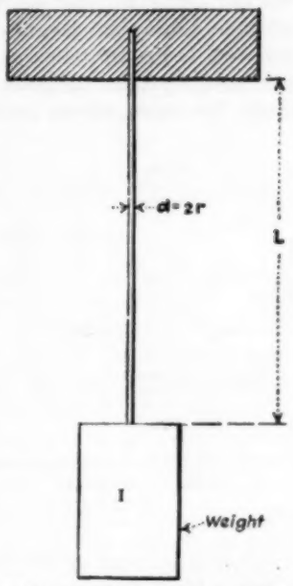


FIG. 1. TORSIONAL PENDULUM FOR DETERMINING "G"

Controlling the Material Index

Having considered the various means of determining the quantities contained in the material index, we will now consider the means of controlling the properties of the various materials used in helical springs, in order to obtain the highest and most suitable value for this index. The desired properties of a material are obtained by controlling the amount of chemical impurities and by giving it the proper heat-treatment. At the same time it must not be overlooked that certain other influences affect the material, such as mechanical or cold working and plating of the material.

Therefore, the important considerations for controlling the properties of a material which affect the value of G and S, and consequently the material index, may be grouped as follows: (a) Chemical impurities; (b) Degree of physico-chemical unequilibrium, due to mechanical and heat-treatment; (c) Frequency of operation as related to fatigue, shock; (d) Electroplating; (e) Corrosion. These classifications will be discussed here in the relative order shown, referring in each case to steel and phosphor bronze (steel particularly), as these two metals are most commonly used for making springs. However, the general principles referred to can also be applied to other metals such as German silver and brass, although these metals generally make poor springs.

(a) Chemical Impurities

Elasticity is the tendency of deformed bodies to resume their former shape. The elastic limit is the limit of stress within which the deformation completely disappears after the removal of the stress, and in certatin materials, in which the stresses are proportional to the deformations. Certain materials, especially steel and phosphor bronze, are highly elastic and in them the ratio of the stress per unit of area to the deformation per unit of length, i.e., the modulus of elasticity, is consistent with the requirements of load and travel of springs used in machine design. The elasticity and strength of relatively pure iron and copper are greatly increased by the addition of certain impurities in definite quantities and decreased by other impurities.

In the case of pure iron which consists of ferrite crystals of high ductility, soft and relatively weak, the addition of small amounts of carbon up to 0.85 per cent content decreases the ductility and increases ultimate strength and hardness, resulting in the material called hypo-eutectoid steel. This is due to the formation of pearlite (a solid solution of carbon and iron) and free ferrite. With the addition of 0.85 per cent carbon to pure iron, which amount goes entirely into solid solution forming all pearlite, eutectoid steel is produced which has the maximum tensile strength, lowest ductility and is very hard. More than 0.85 per cent carbon in iron or hyper-eutectoid steel results in pearlite and free cementite, the latter being low in tensile strength, brittle and extremely hard. In fact, the effect of carbon in steel may be summed up approximately by means of the following formulas, provided that the material is in a normal state of equilibrium:

$$D = 40 - 36\,C;$$

$$T = 50{,}000 + 90{,}000\,C;$$

where

D = Ductility in per cent elongation in 2 inches;

T = Ultimate strength in pounds per square inch; and

C = Percentage carbon.

Therefore, in order to have the most suitable steel for making springs, one having a carbon content of 0.85 per cent to about 1 per cent would be the best from the standpoint of carbon content alone, as this would give the highest value for the elastic limit, or material index, and the ultimate strength. This com-

position would also give the best compromise for resistance to shock and fatigue. The modulus of elasticity for torsion or G would also be a maximum, although a somewhat lower value would not be objectionable.

Other impurities in spring steel and their effects are as follows:

Silicon—Small traces of silicon up to about 0.07 per cent go into solid solution in steel and do not affect its physical properties except to make it slightly more shock resisting. Over 6 per cent will cause brittleness.

Phosphorus—When phosphorus is present in quantities exceeding 0.08 per cent it enlarges the grain size of steel, thereby causing brittleness which would lower the allowable value of S, and the material index because G is probably increased.

Sulphur and Manganese—Sulphur may be present up to 0.1 per cent, but steel of ordinary quality usually contains only about 0.05 per cent. Manganese will combine with the sulphur at high temperatures, thus eliminating the effect of some or all of the latter, which if in excess will cause red shortness, i.e., brittleness. This red shortness is caused by weak FeS membranes forming in between the grains of pearlite. Excess manganese and silicon in moderate amounts will increase S in resistance to shock, but will decrease G slightly.

Nickel—Nickel will increase S, the ultimate strength, and G. Nickel-steel with about 30 per cent nickel content is non-corrosive.

Chromium and vanadium in steel will increase both S and G, but are expensive.

The following steels have been recommended for springs:

U. S. N. Analysis

Open-hearth crucible or electric furnace steel of a minimum of 0.70 and a maximum of 1.1 per cent carbon, a minimum 0.25 and maximum of 0.5 per cent manganese, a maximum of 0.25 per cent silicon, a maximum of 0.04 per cent phosphorus and a maximum of 0.04 per cent sulphur.

Vanadium or other elements may be used to obtain the physical requirements, in which case only the phosphorus and sulphur requirements need be adhered to. Ultimate tensile strength after heat-treatment, 180,000 lb. per square inch, and an elastic limit of 75 per cent of this value.

Pennsylvania Railroad Analysis

Carbon: maximum, 1.0 per cent, minimum, 0.09 per cent. Phosphorus: minimum, 0.05 per cent, maximum, 0.07 per cent. Manganese: minimum, 0.25 per cent, maximum, 0.50 per cent. Silicon: maximum, 0.10 per cent. Sulphur: maximum, 0.03 per cent.

Impurities of Phosphorus Bronze

The chief impurity in phosphor bronze is phosphorus, which reduces the oxides of copper and tin that are formed in melting. Any phosphorus above this necessary amount acts deleteriously and injures the metal. The presence of zinc has a bad effect. Temper is produced by cold rolling or drawing, in which the tin content is the dominant factor. Remelting phosphor bronze will increase its strength. A phosphor bronze of the following composition will give the best value for the material index:

Copper, 90 per cent; tin, 9 per cent;
5-per cent phosphoric tin, 1 per cent

Hence, with steel in the normal state of equilibrium, consisting of iron and impurities within definite limits, as outlined above, we may expect an ultimate tensile strength between 140,000 and 160,000 lb. per square inch, a tensile modulus of 30,000,000 lb. per square inch, with a corresponding value for G of 12,000,000 lb. per square inch, and S (torsion) equal to about 50,000 lb. per square inch. For phosphor bronze, as outlined above, G is equal to about 6,000,000 lb. per square inch and S equal to about 30,000 lb. per square inch.

(b) Mechanical and Heat-Treatment

The values of G and S, as given in the previous paragraph, may be somewhat further increased by mechanical and heat-treatment. Mechanical working or cold wire drawing and rolling distorts the granular structure, pressing it toward the center of the circular section, making it very compact and fibrous, which results in a great increase in the hardness, but which makes the material quite brittle. This brittleness is removed by the annealing process, which consists in heating the steel just slightly above the critical points between 1,455 deg. F. and 1,490 deg. F., in which range the steel is brought into a solid solution or a homogeneous mass. After a sufficient length of time in this range the mass, whose grain structure is now very fine,

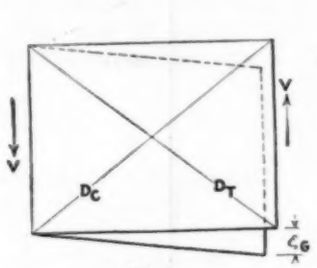


FIG. 2

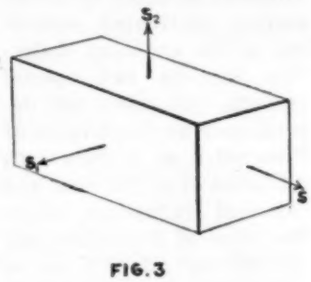


FIG. 3

FIG. 2. ELONGATION METHOD FOR DETERMINING G FACE OF CUBE IN SHEAR. FIG. 3. ELONGATION METHOD. UNIT CUBE UNDER PRESSURE

is allowed to cool at the proper rate, i.e., by plunging it into a blast of cold air. The closer the annealing temperature is to the minimum limit, 1,455 deg. F., the smaller will be the grain size. Wire treated in this way will be very high in tensile strength, and very much greater for small sized music wire. This mechanical and heat treatment increases the strength, the elastic limit considerably, and the modulus only slightly.

Tempered springs of low carbon steel or special alloy steel are usually hardened first by heating to about 1,490 deg. F., and plunging quickly into oil, then giving the desired properties by tempering to about 500 deg. F. The higher the tempering temperature, the lower will be the elastic limit or S. But heat-treatment does not increase the modulus of elasticity G appreciably. Water should not be used as a plunging bath, as it will cause the material to become brittle. Springs which are treated after coiling in order to relieve the internal strains, usually have their dimensions affected, but this will be considered later under spring criterion.

Therefore, with heat and mechanical treatment, the values of S and G may be increased to 130,000 lb. per square inch and very nearly 13,000,000 lb. per square inch, respectively, by using small sized steel music wire, or to about 90,000 per square inch and 12,500,000 lb. per square inch by using steel of relatively large cross-section.

(c) Frequency of Operation, Fatigue, Shock

Fatigue is the loss in molecular strength of a certain material due to an often-repeated stress, depending upon the frequency of application and magnitude of a load below or above the elastic limit. Mr. Guthrie, of the Widney Test Laboratories of Chicago, gives some interesting facts concerning fatigue, in which he shows that the area of the hysteresis loop, i.e., the area between the loading and unloading lines on a pressure-deflection chart is a measure of the material's susceptibility to fatigue. Material whose pressure-deflection chart shows a relatively very small hysteresis loop will probably withstand fatigue fairly well. Therefore, it is recommended that the unloading line be plotted on this chart in order that a suitable factor of safety may be applied to the value of S consistent with the probable service conditions to be imposed upon the spring made from this material.

A greater factor of safety should be applied for sudden and impact loads or shocks. A sudden load or weight dropped from an unappreciable distance on a spring will produce twice the stress that the same load would if gradually applied, while an impact load or one having considerable initial velocity will produce from three to four times the stress of a gradually applied load. The chemical composition and heat treatment as recommended previously are such as to lend maximum resistive power to the material against fatigue or shock.

(d) Electroplating

Small steel springs are plated with silver or nickel and copper in order to protect them from corrosion. Previous to plating, the springs are dipped in a weak solution of HCl to remove the film of black oxide resulting from the heat treatment, the red oxide or rust, and the grease. They are then well plated with either silver or nickel electrolytically, after which they are electroplated in a solution of copper cyanide. A final rinsing in cold water removes all acid.

Certain precautions are necessary in both the cleaning and plating operations. First, the wire to be plated must be kept entirely free from tool nicks and excessive rust, because this will limit to a minimum the length of time necessary to remove the rust. This time should be as short as possible, due to the well-known embrittling effect on steel of the accluded hydrogen evolved in an acid bath.

Also, in the plating operations, the wire is plated first with some metal such as a silver or nickel, which will give off a relatively small amount of evolved hydrogen in the electrolytic bath, because the evolution of hydrogen due to steel in a copper cyanide solution is great enough to cause embrittlement when immersed for only short periods of time. The action of atomic hydrogen on steel is probably due to its penetrating in between the grain structure and building up a pressure which breaks down the cohesive power of the membranes, thereby producing brittleness.

Tinning and japanning tend to temper steel springs, or lower S, but do not affect the modoulus G appreciably.

(e) Corrosion

Corrosion of the raw material, especially the small sized wire, during storage will give considerable trouble. For small sized wire this action will increase the length of time necessary to remove the rust previous to plating, thereby promoting brittleness. The importance of protecting the stored steel wire with grease or chalk dust cannot be emphasized too much.

Plated wire will rust in time if placed in a high humidity, due to the inadequateness of any plating known to give complete protection against corrosion. Phosphor bronze should be resorted to where severe corrosion is expected to occur. The action of CO_2 will form a protective coating on phosphor bronze in contrast to the accelerating action of rust on steel.

With the selection of a material whose properties have been controlled and whose S and G values have been determined as outlined by the above methods, we may expect a high and fairly accurate value for the material index, varying between 0.020 and 0.032 for steel, which will allow a greater value for the spring criterion. In the next article the control of the spring criterion will be considered, along with the results of experiments on music wire.

Derivation of Formulas

Formula (4) $G = \dfrac{2\pi I L}{t^2 r^4}$ Torsional Pendulum.

Let M equal the moment of the couple P, which wil twist the material whose G is sought through one radian; I, the moment of enertia of the suspended weight, see Fig. 1; α, its angular acceleration; and θ, the amount of twist.

Now, as the twist is proportional to the torque, we have

$$\theta M = P = I\alpha \qquad (a)$$

and the torque tending to restore the vibrating pendulum to rest is directly proportional to the angular displacement. Therefore, from the laws of motion, every point in the vibrating pendulum has a simple harmonic motion, which gives

$$\alpha = \frac{\pi^2}{t^2}\theta \qquad (b)$$

where t equals the time of one oscillation. But from the expression above we have

$$M = \frac{I\alpha}{\theta} \qquad (c)$$

By substituting (b) in (c) and multiplying by θ we obtain

$$P = \theta M = \frac{\pi^2}{t^2} I\theta \qquad (d)$$

Now, the deflection formula is

$$\theta = \frac{2PL}{G\pi r^4} \qquad (e)$$

Substituting (d) in (e) we get,

$$G = \frac{2\pi I L}{t^2 r^4} \qquad (4)$$

Formula (5) $G = \dfrac{E}{2(1+\lambda)}$ Elongation.

The action of shear produces internal stresses of tension and compression. Let Fig. 2 represent the face of a cube whose edge is equal to unity and is acted upon by the shear V. This shear causes the cube to become distorted, as shown by the dotted lines, the shorter diagonal of the rhombus being in compression and the longer one in tension. The unit stress S in both cases is equal to V.

By definition, $\epsilon_G = \frac{S}{G}$ where $\epsilon_G = \frac{e}{1} = e$.

From the figure we have,

Before distortion, $D_T = D_C = \sqrt{2}$.

After distortion

$$D_C = \sqrt{(1-e)^2 + (1-e)^2} = \sqrt{2}\,(1 - \tfrac{1}{2}e) \quad \text{approx.}$$

$$D_T = \sqrt{(1-e)^2 + (1+e)^2} = \sqrt{2}(1 + \tfrac{1}{2}e) \quad \text{approx.}$$

Hence, in either case, the change in length for each diagonal is $\frac{1}{2}e\sqrt{2}$ and per unit length is equal to $\frac{1}{2}e = \epsilon_T$

$$\therefore \epsilon_T = \tfrac{1}{2}S/G \qquad \text{(a)}$$

Now, the change per unit of length ϵ_T will be found by another method, as follows:

Unit Elongation, ϵ_T due to S equals $\frac{S}{E}$

But the lateral contraction due to S_1 equals $\frac{\lambda S_1}{E}$ in the opposite direction and the lateral contraction due to S_2 equals $\frac{\lambda S_2}{E}$ in the opposite direction, see Fig. 3.

Hence the total effect is given by the following:

$$\text{True } \epsilon_T = \frac{S}{E} - \left(\frac{-\lambda S_1}{E}\right) - \left(\frac{\lambda S_2}{E}\right) \qquad \text{(b)}$$

λ is sometimes called Poisson's Ratio.

In the case above, $S_2 = 0$ and $S = S_1$ numerically.

$\therefore$ (b) becomes

$$\epsilon_T = \frac{S}{E} + \lambda\frac{S}{E} = (1+\lambda)\frac{S}{E} \qquad \text{(c)}$$

Equating (c) equal to (a) we obtain

$$(1+\lambda)\frac{S}{E} = \tfrac{1}{2}\frac{S}{G}$$

or

$$G = \frac{E}{2(1+\lambda)} \qquad \text{(5)}$$

ERRATUM

In the first article published by Mr. Wood under the title of this article, some typographical errors occurred. On page 631 in the first column the fifth line from the bottom of the page should read

$$P = \frac{\pi}{8} \times \frac{S^2d^2L}{Gf},$$

and the third line from the bottom

$$P = \frac{\pi^2S^2d^2DN}{8\,Gf},$$

the f being transposed in both cases. The last line should, then, read

$$P = \frac{\pi^2S^2dDH}{8G\,(h-H)}.$$

Also, the third line from the top of the second column on the same page should be

$$\frac{\pi}{8} \times \frac{Sd^3}{D} = \frac{\pi^2S^2dDH}{G\,(h-H)}$$

On page 632 in the last line of the article, the bracket $\left(\frac{D}{d^2}\right)^2$ is incorrect and should read $\left(\frac{D}{d}\right)^2$, as is evident from the other formulas in the article.

Annual Report of American Engineering Standards Committee

The forthcoming report of the American Engineering Standards Committee will contain a resumé of the work done by the organization during the last year which should be of interest to every manufacturer and engineer.

The plan of organization and functions of the committee are clearly outlined in the following abstracts from an address by P. G. Agnew, Secretary of the American Standards Engineering Committee, at the Standardization Conference of the American Mining Congress, Nov. 17, 1920.

"During or since the war, national engineering standardizing bodies have been formed in all of the leading countries excepting Japan, where one is now in process of organization. All of these are similar in form of organization and method of operation to the British Engineering Standards Association, which has existed since 1901.

"Our own organization, the American Engineering Standards Committee, was organized in October, 1918, and has been actively at work for about a year. The functions of the committee are: To unify methods of arriving at engineering standards; to secure co-operation between various interested organizations in order to prevent duplication of work and promulgation of conflicting standards; to act as an authoritative channel of co-operation in international engineering standardization; to promote in foreign countries the knowledge of recognized American standards; to collect and classify data on standards; and to act as a bureau of information regarding standardization.

THE WORK OF THE COMMITTEE

"The scope of the work which is being carried out under the auspices and rules of procedure of the committee is very broad. The following types of projects are among those under way: (a) Definitions of technical terms used in engineering work, specifications, and contracts; (b) specifications for materials; (c) methods of tests, especially acceptance tests for materials and apparatus; (d) dimensional standardization to secure interchangeability of supplies, for example, screws, nuts, and bolts; (e) dimensional standardization to secure the inter-working of parts and of inter-related apparatus made or assembled by different manufacturers, such as shafts, pulleys, etc.; (f) safety codes to secure uniformity in requirements for safety in apparatus and equipment, and in industrial processes; (g) the limitation of the number of types, sizes and grades of manufactured products—an exceedingly important and far-reaching subject.

"The standardization movement is one of co-operation throughout each branch of industry and the different branches of industry whose interests touch or overlap, and a large measure of international standardization must inevitably result. For years there has been growing feeling among leaders in industry, which was heightened by the experiences of the war, that our industries function too much as independent units and not enough as articulated parts of a national whole. It is not too much to say that standardization offers a major opportunity toward the integration of our industries on a national scale, so that they may function in a truly national way."

Machining the Rolls-Royce Cylinders

Machining Each Bore Separately—Securing Uniform Compression — Lapping Cylinders After Careful Grinding

BY FRED H. COLVIN
Editor, *American Machinist*

THE cylinders for the Rolls-Royce motor are cast in blocks of three cylinders each, as in the case of a few motors of American design. The castings are first sand-blasted, and then marked out on a layout table for boring. This is done to equalize the distribution of metal in the various cylinders and to be sure that the casting will clean up properly in the various machining operations.

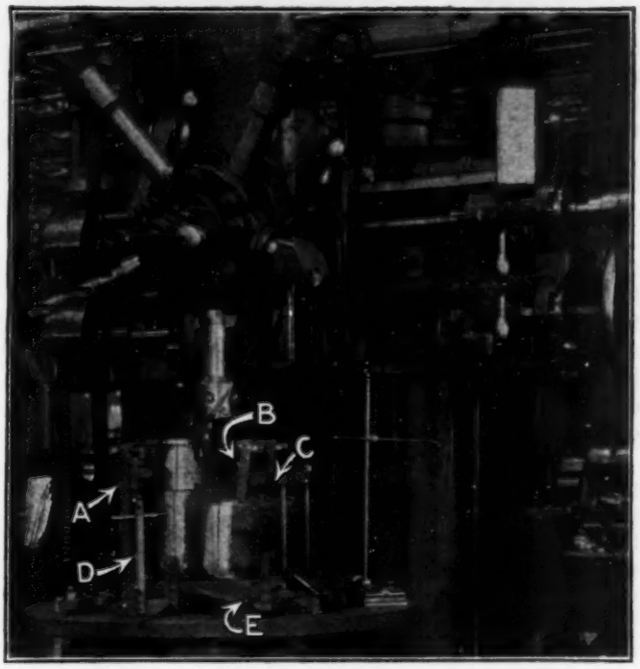


FIG. 1. BORING AND FACING THE CYLINDER BLOCK

The first machining is to bore, face and chamfer on a Bullard boring machine, as shown in Fig. 1. A special indexing fixture is provided by which the cylinder block can be moved from one position to another, as each cylinder is bored separately. The tool layout can be readily seen as well as the arrangement of the fixture and some of the gages. The fixture consists primarily of the angle plate *A*, the cylinder being properly located by means of the scribed layout line shown. The clamp *B* holds the cylinder flange firmly against the upright of the angle plate, while the clamp *C* holds the cylinder against the lower half of the plate.

The cylinder head is domed in the compression space, the gage *D* being lowered into the bore to see that the length is correct. Special calipers *E* measure the undercut for the over-run of the piston ring. Great care is taken to secure the uniform cubical contents of each cylinder, the tolerance being only one-half cubic inch variation between them. This is measured, as will be shown later. If the volume of any cylinder is too great, the whole block is brought back to this machine and the flange faced so as to reduce the volume to the desired amount.

The top of the cylinder casting is next milled on a large Becker milling machine, after which the holes in the top are drilled, spot-faced, countersunk and the water plug holes tapped. Next comes the drilling and facing of the lugs on the cylinder base, after which the cylinders go for the usual water test, as illustrated in Fig. 2. Then come the usual milling and drilling operations, boring and tapping for valve cover plugs, valve seating, recessing valve pockets, etc. After all the drilling and tapping has been done, all burrs are removed and another water test is given the cylinder block on the same fixture as before.

The rough grinding of the cylinder bores on a Heald machine comes next, the fixture used being shown in Fig. 3. A circulation of water is maintained through the cylinder jackets and the dust of grinding is taken away by the exhaust pipe shown at the rear. It will also be noted that a holder for the wheel-truing diamond is fastened to the face of the fixture at *A* so that the wheel can be kept in good shape with the least trouble. After the cylinders are rough ground, they are also very carefully finish ground. Great care is taken to have the finishing machine in the best possible condition with all bearings snugly taken up so as to secure the best results it can produce.

MEASURING THE VOLUME

The cylinders are then ready for the volume or capacity test, which has been previously referred to and

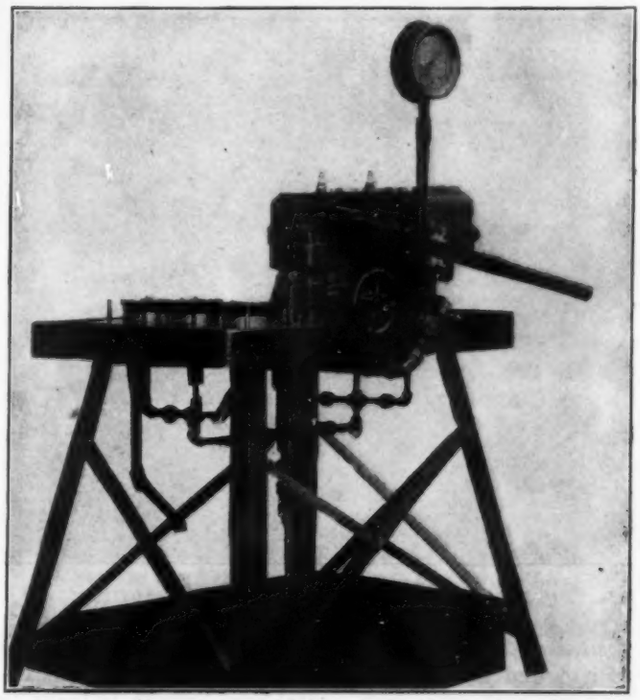


FIG. 2. THE WATER TESTING FIXTURE

which is shown in Fig. 4. This shows a micrometer gage in place in the right-hand cylinder to measure the length of the bore and the compression dome. At the left is a

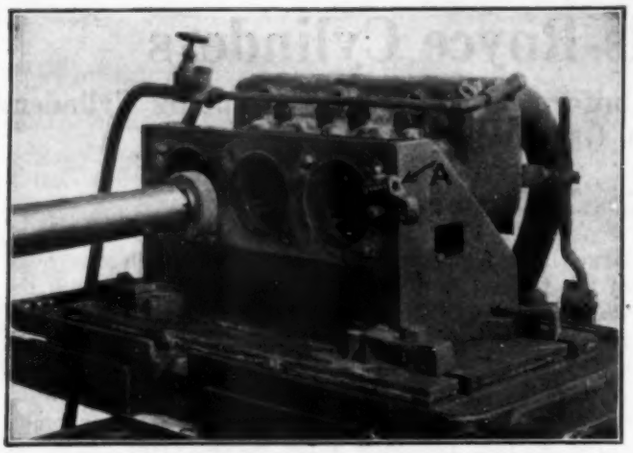


FIG. 3. GRINDING THE CYLINDER BORE

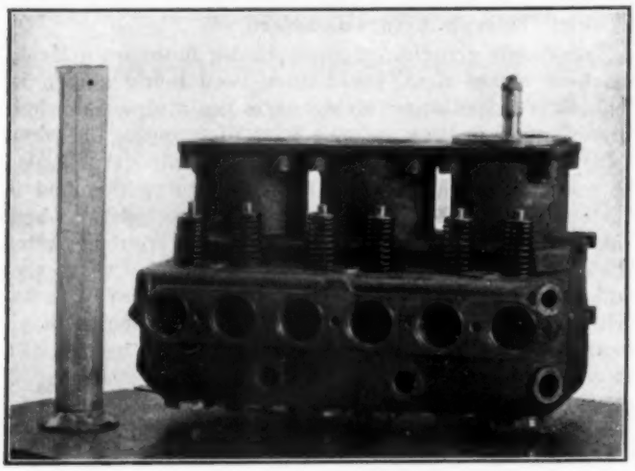


FIG. 4. MEASURING THE CUBICAL CONTENTS

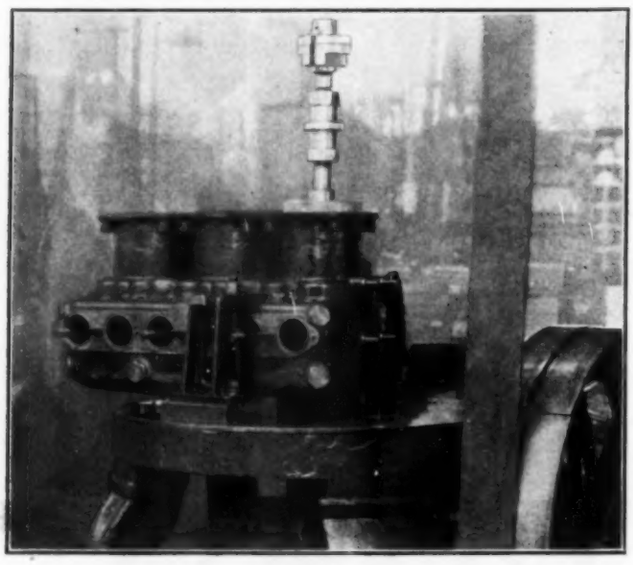


FIG. 5. THE CYLINDER LAPPING MACHINE

graduate to measure the liquid which is poured into each cylinder bore in turn. Should the variation exceed one-half cubic inch, suitable correction is made to bring each cylinder within this limit.

Before assembly, each cylinder is carefully lapped on the device shown in Fig. 5. This machine has a turntable on which the cylinder block is mounted as shown, and on which any desired cylinder of the block can be brought under the lapping spindle. In order to avoid any erroneous impressions in regard to the lapping, it may be here stated that the finish grinding is as perfect as can be secured. The lapping, which is of extremely short duration, is only done to make sure that there is a good bearing in every portion of the cylinder wall. The cylinder block can be readily shifted from one bore to another, exact alignment being unnecessary owing to the flexible connection in the lapping spindle.

A Student Apprentice Course

BY A. W. FORBES

I am thinking of taking some apprentices on the basis outlined herewith and thought it might be of interest. I have never heard of apprenticeship being run on such a basis, but presume it has been tried thousands of times. I should be glad to have comments from any source.

(1) Object: Training for positions of foreman, tool maker, tool designer, machine designer, electric motor designer.

(2) Requirements for admission: Sex, male; age, from 14 years up; must have shown ability in school to keep up with normal requirements in all subjects. Must have shown technical or scientific ability by studying some technical, mechanical or scientific subject for not less than two years, outside of school, and not under the direction of an older or experienced person. Personal character must be satisfactory.

(3) Work and Study: Work for shop or office as assigned. The work will in a general way be preparatory for the position that the apprentice has in view, but the management reserves the right to require temporarily any work in the shop or office. A moderate variety of work will be offered which must be thoroughly learned, but no attempt will be made to include all operations.

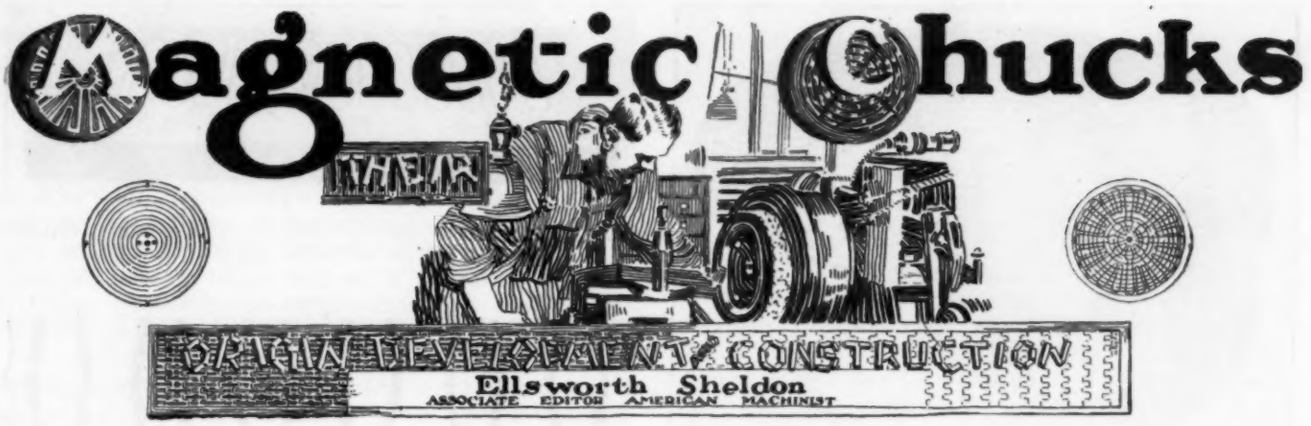
School study will consist of one or possibly two courses at a high school or college. The selection will be for general education and in no way vocational. The selection will be made by the apprentice, subject to the approval of the management.

Vocational study will be done independently in consultation with the management. This will be specialized on topics related to the work, and will take the form of research work. In general these topics will be such as have never been thoroughly studied and the results will be published. A new topic will be selected about once in three months, and part of the former topics continued. One or two topics should be continued for three or more years.

(4) Hours: Work from 25 to 35 hr. per week; school study from 5 to 10; vocational study from 10 to 15, and total from 45 to 55.

(5) Compensation to start at from 20 to 30 cents per hour, according to age and experience, to be increased once in three months without limit. In addition, three dollars per month will be allowed for special books and laboratory supplies for vocational study, to remain the property of the firm.

A satisfactory quality and quantity of work will be required in all lines, as well as reasonable progress in all branches of learning. Both parties reserve the right to terminate the agreement should it prove unsatisfactory.



VI. The Heald Chuck

First of the Multiple Magnet Chucks—Does Not Depend Upon the Shell for Magnetism—Differs Little in Appearance from the Single Magnet

THE Heald Machine Co. builds grinding machines. Like the Blanchard Co. its entrance into the field as a manufacturer of magnetic chucks was due to a desire to make a table for a rotary grinding machine that should be better adapted to the peculiar needs of

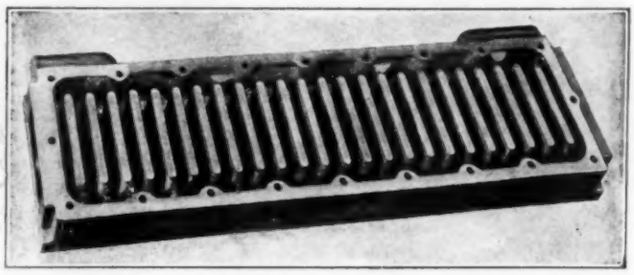


FIG. 88. BODY OF HEALD RECTANGULAR CHUCK WITH SINGLE ROW OF CORES

Heald machines than anything already in existence. Investigation and experiment led to the development of a device somewhat different in principle from any magnetic chuck on the market in that each pair of poles presented to the work-holding surface constituted a complete magnet in itself, not depending upon the shell or chuck body as a part of the magnetic circuit except such small portions of the casting as lay between each pair of cores.

The exposed poles were therefore alternate in polarity as in the single-magnet chuck, but with the difference that between each pair there would be a neutral zone

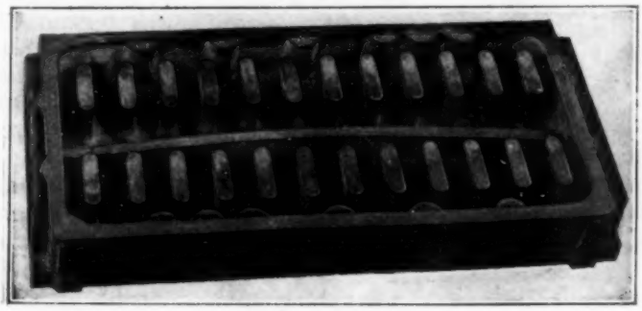


FIG. 89. BODY OF HEALD RECTANGULAR CHUCK WITH TWO ROWS OF CORES

that became an induced or extended pole, either north or south-seeking, according to the way in which work was laid upon it.

Instead of one large central core with a correspondingly large coil of current-carrying wire wound upon it, there were several pairs of narrow cores, each with its individual coil, and though they were still cast integral with the chuck body they were practically independent of it magnetically. This chuck is regularly built in both the rotary and rectangular form, and in many sizes.

The body, or shell, of the rectangular chuck is shown in Fig. 88. As may be seen, it is a single box-like casting of malleable iron with the magnet cores extend-

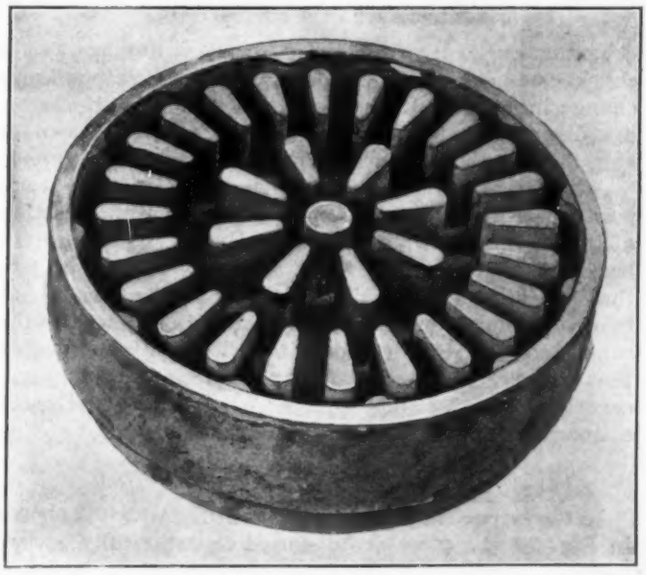


FIG. 90. BODY OF HEALD ROTARY CHUCK

ing flush with the open top. There is but one opening in the body of the casting below the top, and that is the one that carries the leading-in wires. In machining the top plate and body great care is taken to secure true and accurately finished surfaces, thus when the top plate is put on and the lower opening sealed with the pipe-plug which is a part of the current-carrying cable, the chuck becomes water tight.

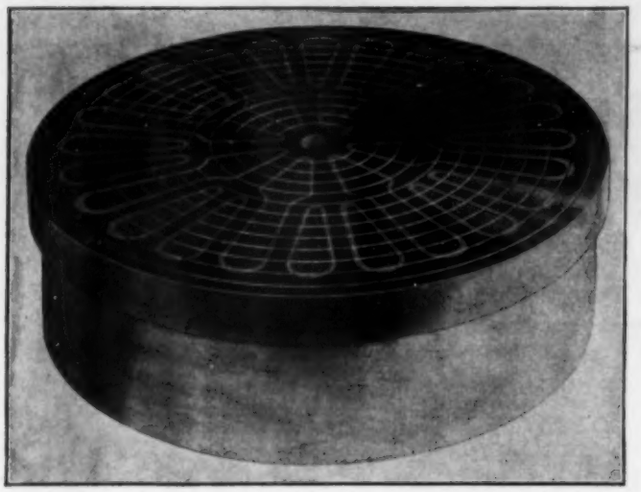


FIG. 91. A HEALD ROTARY CHUCK

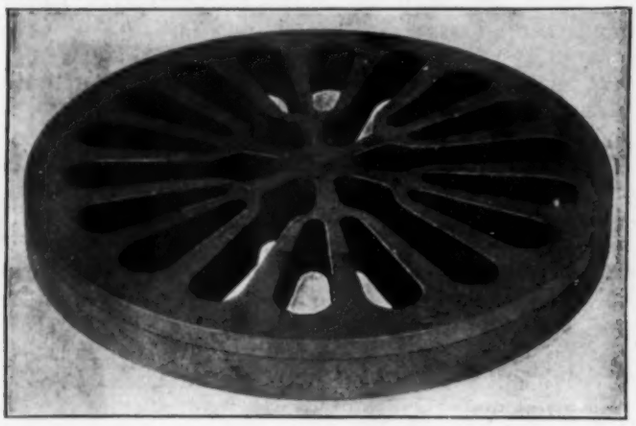


FIG. 92. GRID OR TOP PLATE OF HEALD ROTARY CHUCK

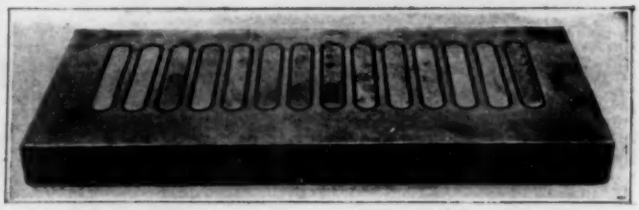


FIG. 93. GRID OF RECTANGULAR CHUCK WITH POLE-PIECES SET FOR POURING

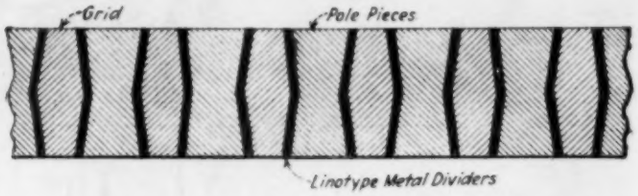


FIG. 94. SECTION THROUGH CENTER OF TOP PLATE

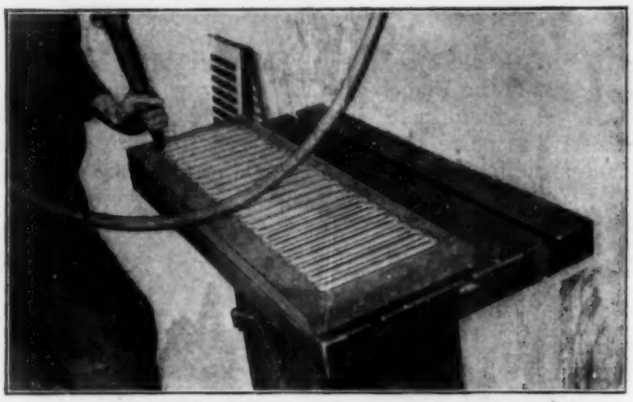


FIG. 95. STAKING IN THE FILLER

The magnet cores are always even in number and a chuck can be built to any desired length without any change in design. If a wider chuck is wanted, the cores are disposed in two rows instead of one, as shown in Fig. 89, but the magnetic construction is not different.

Adjacent cores are of opposed polarity; thus each pair constitutes a complete magnet of which that section of the shell bottom lying between the cores becomes the back-bar. When two rows of cores are used, each two that are in line widthwise of the chuck are really but two parts of the same core, and are both covered by the same polepiece in the top plate. Two coils, so joined that the electric current flows the same way in each, cover these parts; thus forming what is practically one coil surrounding one core.

The Rotary Chuck

In the larger rotary chucks, a shell for which is shown in Fig. 90, the cores are disposed concentrically in two circles. The cores in the outer circle alternate in polarity, as do those in the rectangular chuck. In the inner circle the cores are so disposed that each core is radially in line with one core of the outer circle and, as explained with reference to Fig. 89, becomes in effect a part of that core.

As the relative number of cores in each circle is so calculated as to bring one core of the inner ring into radial conjunction with every third core in the outer ring, it naturally follows that these inner cores also alternate in polarity. As may be seen in Fig. 91, every third polepiece of the magnetic surface is extended toward the center of the chuck and enlarged to cover the corresponding core of the inner circle. The arrangement not only makes each adjacent pair of cores a complete magnet, but each pair of the extended cores also forms a complete magnet. Any piece of work, therefore, that is placed in any position upon the chuck shown in Fig. 91 will cover at least one pair of magnet cores and thus complete a magnetic circuit.

FIG. 96. STAKING TOOL

Turning and facing operations on the rotary chuck parts are performed on the Bullard vertical turret lathe. The rim and tops of the magnet cores are first swept off and the outside of the shell turned as far as the jaws of the holding chuck will permit; then the piece is turned over to finish this cut and to machine the back. All these operations are followed by what is called finish cuts but the actual finishing cut on many of the chucks is by grinding. No machining is done on the inside of the casting.

Machining the bodies of the rectangular chucks is regularly performed while they are held by their counterparts, the finished chuck.

Roughing cuts are made upon a double head Ingersoll milling machine. Some of the finish cuts are

made upon the same machine and some upon the planer, but the real finishing cuts upon which the product depends for accuracy and uniformity is, as in the case of the rotary chucks, by grinding.

The top plates, or grids, of the Heald chucks, one of which for the rotary chuck is shown in Fig. 92, are of grey iron. These parts are not expected to carry magnetic currents and therefore material of high magnetic permeability is not necessary. The polepieces are malleable iron castings thoroughly annealed. In this condition malleable iron approaches soft steel in its magnetic characteristics.

No machining is done on the polepieces previous to setting them in the grid, except to remove burrs or fins that may be on the castings and to hand grind one face so that they will lay flat on a surface plate. The grids, both round and rectangular, are rough milled on both sides. A rectangular top plate with the polepieces set for pouring the binding material is shown in Fig. 93. A section through the openings of the grid with the polepieces in place is shown in Fig. 94.

Pouring the Non-Magnetic Binder

The non-magnetic binding material used by the manufacturers of Heald chucks is linotype metal. The same property is required here as in the casting of type; the property of filling sharply at the instant of setting all the little crevices and irregularities that must of necessity exist in the unmachined surface of a casting from a sand mold. This roughness of surface presents

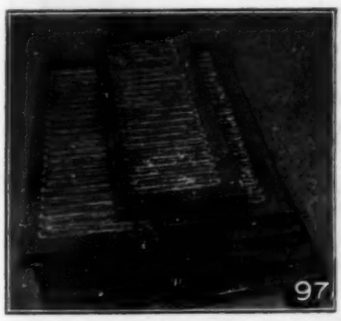


FIG. 97. RECTANGULAR TOP PLATES AFTER STAKING
FIG. 98. TOP PLATES OF ROTARY CHUCK AFTER STAKING

a decided advantage as it tends to increase the firmness with which the polepieces are held in the cast iron grid and make the chuck more able to withstand the somewhat rough usage to which it is likely to be subjected in service.

Placing a grid on a heavy surface plate in position convenient for pouring, the operator sets in the polepieces, gaging them by appearance to show an equal amount of space all around. The molten linotype metal is then poured into the openings, filling them up and piling up on the surface of the grid. After cooling, the surplus metal is melted off with a gas torch and any remaining imperfections corrected. The metal in the grooves is then staked or calked by means of a pneumatic hammer, as shown in Fig. 95, the tool used being shown in Fig. 96. A number of top plates after this operation are shown in Figs. 97 and 98.

Following the staking the top plates are milled or planed on both sides, and one side is ground to make the water tight joint between itself and the body of the chuck.

(Continued in next week's issue)

Selection and Use of Diamonds for Truing Abrasive Wheels

By C. C. Hill

A diamond when used with a little common sense is the cheapest tool with which to true a grinding wheel for either rough or finish cylindrical grinding.

The foregoing statement is based upon an exhaustive study made by the writer, running through a period of twelve years, after trying every known substitute that is supposed to replace the diamond.

After many competitive tests in which complete service records were kept, I found that the two best stones adapted to truing cylindrical grinding wheels were the African brown bort and the African grey bort. The stone should be mounted in a special metal nib which has a very low melting point and which at the same time has a high coefficient of expansion. The molten metal cast around the diamond contracts upon cooling and holds the stone firmly as if it were an integral part of the nib.

The resetting of a diamond is not a tool room proposition. It should be returned to the manufacturer who is equipped to do this correctly and more economically than the tool room with its makeshift methods.

Many diamonds are broken or cracked by the operator running the wheel into the diamond when bringing the wheel forward preparatory to truing, or by taking one or two cuts across the wheel face dry and then flushing the diamond with cold compound.

I have found the majority of grinding machine operators can soon be taught the proper method of using the diamond to produce quality work on a productive basis.

Careful Usage Prolongs Life

The following hints should help reduce the diamond costs and increase production in the grinding department:

(1) Be careful not to jam the wheel into the diamond.

(2) Use a copious supply of compound when truing the wheel, as this dissipates the heat and keeps the diamond at an even temperature.

(3) Turn the nib in the holder often, as this causes a new surface to come in contact with the wheel and prevents wearing a flat spot on the diamond.

(4) Keep a card-index system and keep records of your diamonds and the operator. Instruct the careless operator and commend the careful one.

(5) Special attention should be given the selection of a diamond for shaping the wheel for form grinding or truing radii. For these operations a diamond of oblong shape should be selected so that the stone will protrude far enough that the wheel will not grind away the mounting and loosen the diamond.

There is no economy in using small stones. The larger the stone the more economical it is. The accompanying table may be used as a guide for computing the size of diamonds for a given diameter of grinding wheel:

Wheels, Medium and Softer		Wheels, Medium and Harder	
Wheel Size, Diameter, In.	Diamond Size, Carats	Wheel Size, Diameter, In.	Diamond Size, Carats
14	1½	14	2
16	2	16	2½
18	2½	18	3
20	3	20	3½
22	3½	22	4
24	4	24	4½
26	4½	26	5

Ideas From Practical Men

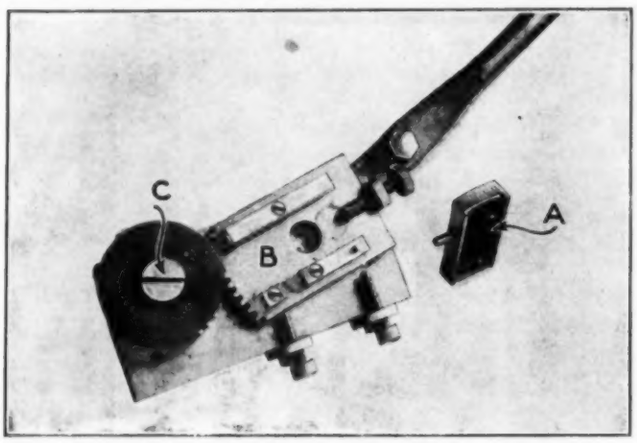
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Device for Rolling Graduation Marks

By Amos Ferber

The part shown at *A* in the illustration had to have the graduations put on the end, and to keep down manufacturing costs it was necessary to provide some means of doing the work quickly and well. The device shown here, though necessarily made with care, involves no expensive parts other than the die.

The part *B* swivels near the center upon a stud that is attached to the hand lever, and upon one end are cut teeth to mesh with the small gear that turns upon the stud *C*. This small gear may be of any diameter not too large, and such a gear can be found in almost any machine shop without going to the expense of making a special one. The disk in which the die is dove tailed must, of course, be of a size to equal the pitch diameter of the gear used and the teeth on part *B* must also be made to mesh properly with those of the gear. The disk and gear are screwed and dowelled together. The die blank is made separate from the disk in order that it may be replaced when worn out without making a new disk. It is turned up in place and the graduations (the reverse of those to appear on the work) cut on a milling machine. It is also made in two parts —the lines on one part and the figures on the other— both because it is easier to make that way and because lines and figures do not always wear out together.



DEVICE FOR MARKING GRADUATIONS

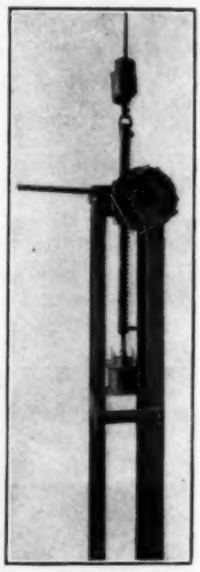
The whole device is held in the jaws of an ordinary bench vise, and to operate it, it is necessary only to drop in a piece of work, hold it down with the fingers and pull down the lever. The work fills the channel in part *B* and is gaged for impression by the knurled head screw at the end. The other two screws are in the block and limit the movement of part *B*.

The device was made by M. B. Hill, of Worcester, Mass., for the purpose of graduating the shells of a test indicator manufactured by him.

A Home-Made Arbor Press

By Milton Wright

A serviceable arbor press, every part of which except the rack and pinion and the screws that hold it together came from the stock rack or the scrap pile, is shown in the accompanying illustration. Besides the advantage of low material cost the press was built at odd times by the boys, and thus the total cost was insignificant. The construction is so obvious from the illustration that little description is necessary.



A HOME-MADE ARBOR PRESS

Two pieces of 2 x ⅝-in. cold-rolled bar and two small L-section structural bars form the uprights which are tied together in two places by short pieces of the angle iron and pieces of cast iron—old parallels. The parallels on which the work is resting are movable, to accommodate different sizes of arbors.

The disk to which the lever is applied is a piece of scrap to which four pieces of angle iron have been riveted, so that a bar can be used in almost any position. The ram is counterweighted by another piece of scrap hung on a cord which runs over a sheave in the floor above. As the press was made in a shop where autogenous welding is regularly done many of the joints are reinforced by welding, but this is not necessary to render it serviceable for the ordinary run of jobs.

Aligning Shafting by a Steel Wire

By Henry J. E. Reid

Some time ago you wrote me inquiring about my comments concerning the use of steel wire for aligning shafting. I am sorry to say that conditions at the factory made it almost impossible for me to follow this up promptly. However, the following is a brief description of the method used and the calculations for the tables:

In Fig. 1 is shown the set-up used. The upright members were pieces of 4 x 4-in. spruce so as to give rigidity. The pulleys were approximately 10 in. in diameter, being mounted so that they revolved easily and were adjustable, both vertically and horizontally. The vertical adjustment is shown in Fig. 1, while the horizontal adjustment is shown in Fig. 2. The weights, as shown, were 60-lb. castings, while the wire was No. 76 gage stubbs steel wire, 0.018 in. diameter and weighing 0.0009 lb. per foot.

In Fig. 3 is shown the position of the aligning wire

with respect to the shaft, the wire being placed so that it was directly under the same side of the shaft at each end of the set-up. To obtain this condition a plumb bob was dropped over the shaft at each end and the wire adjusted so that it was directly under the plumb bob, as shown in Fig. 3. It was then easy to align the shaft in a horizontal plane by dropping a plumb bob at each successive hanger and moving the shaft over so that the plumb bob was directly over the wire.

To obtain the vertical alignment the sag of the wire had to be known. Upon checking up the tables given on page 490 of "American Machinists' Handbook" it was found that for No. 17 gage Birmingham wire the sag was too small. It was also found that the tables could be used only for shafting up to 280 ft. in length, while our longest line was 330 ft. It then became necessary to find a formula and from it calculate a table. For these calculations I used the formula for the parabola, which, as stated on page 1693 of "Pendler's Electrical Handbook," is accurate within 2 per cent for sag of 60 ft. or less in 1,000 ft. This was, therefore, far more accurate than we were able to measure it with our apparatus as the sag was so very much smaller than 60 in 1,000. That is, the percentage of error was not so much with a small sag. The true form of the curve, of course, is the catenary, but this formula is rather difficult to work out.

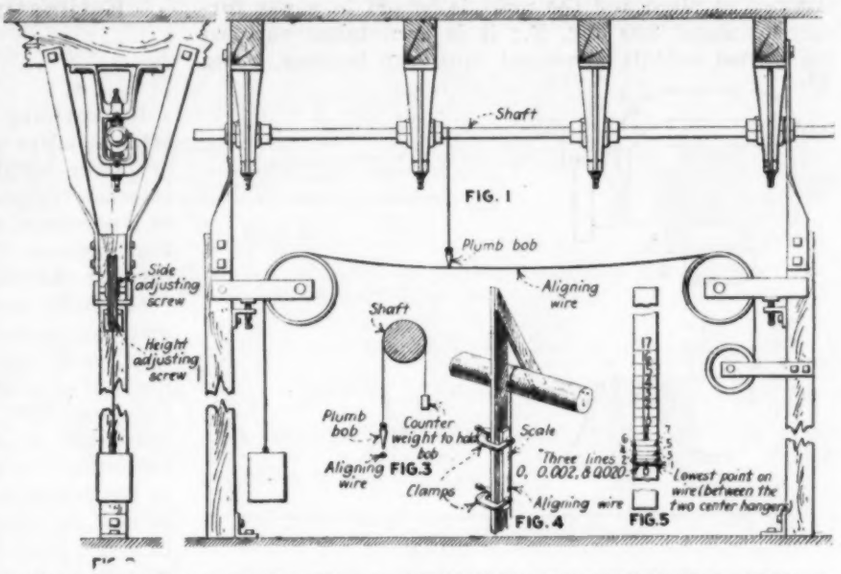


FIG. 1. THE SET-UP USED. FIG. 2. PROVISION FOR HORIZONTAL ADJUSTMENT. FIG. 3. POSITION OF ALIGNING WIRE IN RELATION TO SHAFT. FIG. 4. THE SCALE IN USE. FIG. 5. THE SCALE (ACTUAL SIZE)

The following calculations were used in determining the table:

The general formula of the parabola is: $y = kx$; y then $= \frac{0.0009 \times 12}{2 \times 60} x$, substituting the constants below; 0.0009 is weight in pounds per foot of wire tending to carry the wire down; 12 is to bring y in inches when x is in feet; 2×60 is the force applied to each end of the wire; y in inches then, equals $0.00009 \times x^2$ when x is in feet.

The sags, then, for 10-ft. intervals on the 320 and 330-ft. shafts are as follows:

320-Ft. Shaft		330-Ft. Shaft	
x	y	x	y
10	0.009	5	0.002
20	0.036	15	0.020
30	0.081	25	0.063
40	0.144	35	0.110
50	0.225	45	0.182
60	0.324	55	0.273
70	0.441	65	0.380
80	0.575	75	0.506
90	0.729	85	0.649
100	0.900	95	0.812
110	1.088	105	0.995
120	1.295	115	1.190
130	1.520	125	1.405
140	1.765	135	1.638
150	2.025	145	1.890
160	2.303	155	2.160
		165	2.450

From these tables two scales were prepared, one for shafting having an odd number of hangers, the other for shafting having an even number of hangers. In other words, for shafting on which the center was at a hanger, or $x = 0$, in the formula and where the center of the shaft, or $x = 0$, was between two hangers. Fig. 5 shows one of the scales for 330-ft. shaft. To use this scale for other than 330 ft. the number of hangers were counted, divided by two, and that number marked on the scale was used as a starting point. The scale was mounted on a hook, as shown in Fig. 4, and the aligning wire adjusted to the starting number on the scale at each end of the shaft. It was then only necessary to proceed from hanger to hanger and bring the shafting down or up until the aligning wire came opposite the corresponding mark on the scale. This aligned the shaft both horizontally and vertically. As a matter of fact, the two alignments were made at one setting at each hanger.

With a good mercury plumb bob, a carefully prepared scale, and careful work of aligning, one should be able to get the alignment within $\frac{1}{64}$ inch.

[The alignment of line shafting in machine shops is accomplished in various ways according to the experience and inclination of the men in charge. The plan of using steel wire and measuring its sag was brought out in the *American Machinist* about fifteen years ago and has been used to a considerable extent since that time.

Some of the users of this method found that the amount of sag given in the tables published at that time was too small for the wire now used for this purpose and we are indebted to Mr. Reid for his experiments along this line.—EDITOR.]

Babbitting Mold for Bearings

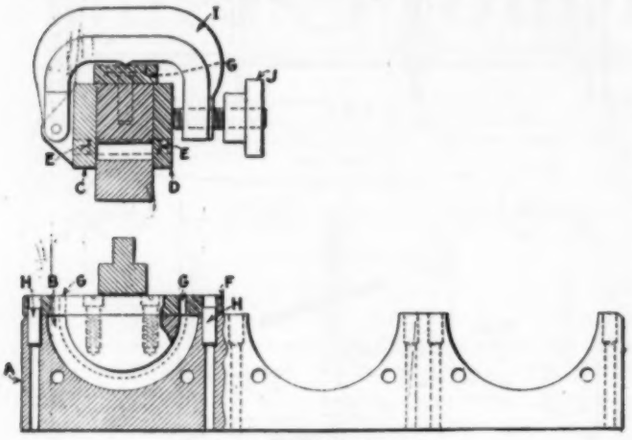
BY C. H. DENGLER

The fixture shown in the illustration is used to babbitt three engine crankshaft bearings, simultaneously, by the puddling process. It consists of a baseplate *A* into which three half-moon shaped forms *B* fit snugly. The two sides of the fixture or mold are inclosed by the loose plates *C* and *D*, which are located by the dowel pins *E*. The top plate *F* covers the mold completely and has two slots *GG* in each section into which the babbitt is poured.

The slots are so formed that the babbitt will stay with the bearing when the mold is broken. Dowel pins *HH* line up the top plate, to which the forms *B* are fastened, in relation to the bearing. Clamp *I* is hinged to the cast-iron sidepiece and holds the three loose plates together. It is quick acting, the screw *J* being offset to secure a two-way clamping effect.

The fixture is used as follows: The bearings are

clamped in place and the mold is heated in a gas furnace to about 800 deg. F.; it is then taken out and the melted babbitt is poured into each bearing, being



THE BABBITTING MOLD

puddled with a wire through the slots to force the air out and make a non-porous bearing. We obtain fine results with this method. The bearing shells are steel and in order to make the babbitt adhere to them, they are first tinned.

The bearing produced in this way has the same expansion as the steel crankshaft and works equally well, hot or cold, the running clearance being always the same. This is not true of a bronze-to-steel bearing due to the different coefficient of expansion.

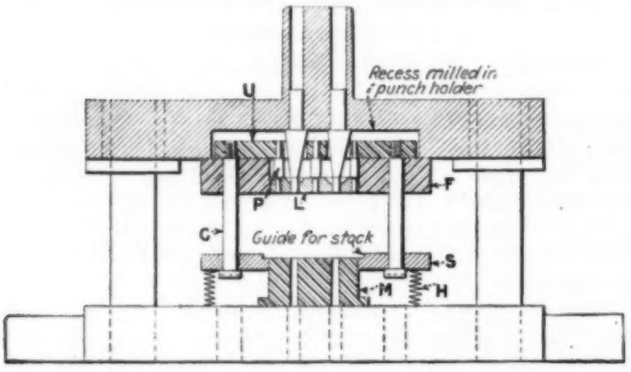
Positive Stripper for Compound Dies

BY J. F. THORNTON

The sketch illustrates a stripper and knockout for use in compound blanking and forming dies, which does not necessitate the use of springs or rubber.

The stripper *S* is connected to the knockout or shutter *U* by the connecting links *C*, which slip in the stripper as the punch descends. The lower member of knockout *L* is secured to the shutter by riveted shoulder pins *P*. The male member *M* is held to the shoe in the conventional manner, as is the female member *F* to the punch-holder.

The links *C* slip in the piece *F*, allowing the knockout to rise as the punch descends. Four light helical springs *H* are furnished to support the stripper until the punch finishes its descent. This is necessary only



POSITIVE STRIPPER FOR COMPOUND DIES

to steady the stock until the punching operation is completed. This method cannot be used to force the punching back into the stock.

Estimating the Horsepower Required to Drive Machinery

JOHN S. WATTS

In providing for the power to drive a machine, it is often a matter of some difficulty to determine the amount of power which will be absorbed in overcoming the internal friction of the mechanism. If the machine is of a new type, trouble is often experienced in its operation because the driving gears are made too weak, through the friction having been underestimated.

Generally speaking, the power required to operate a machine, neglecting friction, can be calculated with a very close approach to accuracy, and if a similar machine of a different size is in operation and available for test, the friction load can be determined and calculated as a percentage of the useful load. The percentage so determined, can be used with confidence in the design of the new machine. When the apparatus is new in type, the friction load should be calculated in detail from a study of the friction of each unit of the moving parts and of the component parts of the driving gearings.

It is to be regretted that very little has been published on the friction losses of the various types of machines in use, outside of the most common ones, such as electric motors, engines and hoists. By this, I mean the total loss in the machine as a whole in relation to the useful work performed.

On the other hand, numerous tests on the various kinds of power transmission appliances, such as gears, worms and screws, have been made and the results published, but the information is so scattered among technical journals, text books, etc., and usually so mixed up with a mass of other information, that it takes considerable time to arrive at the desired data.

The common method of assuming an average of, say 75 per cent for all classes of machines is apt to be very wrong and to lead to serious errors, because the actual efficiency may be as low as 15 per cent, as in the case of a screw thread, and up to 95 per cent for a pair of cut gears.

In some cases the friction load is the full load, as, for example, in the case of a revolving screen or a horizontal conveyor; and in order to be able to design a satisfactory machine, it is necessary to be able to estimate the power required to overcome the friction, with a fairly close approach to accuracy. For the above reasons I have found it useful to collect for quick reference all the available information on the efficiency of the various gearing, and no doubt the table which follows will be a help to others.

Belt pulley, with two bearings	95 per cent
Chain sprockets and bearings	97 per cent
Spur gears with two bearings (at low speed)	90 per cent
At high speed	98 per cent
Bevel gears, including thrust	90 per cent
Worm (depending upon the inclination of the threads)	50 to 95 per cent

Bearings—Co-efficient of friction, 0.15 for plain, to 0.015 for flood oiling.
Ball or roller bearings, co-efficient of friction, 0.0015.

The efficiencies are those obtained in average practice, under average conditions as to loads and pressures; and under reasonably good conditions they may be regarded as the maximum, and used as such in calculating the power required.

To illustrate the procedure recommended in calculating the friction power requirements of a machine, we will take as an example the power required to drive a revolving screen, 6 ft. in diameter, by 20 ft. long, at 16 revolutions per minute. The material passing

through the screen is coal, the maximum quantity to be 100 tons per hour, with an inclination of the screen of 2 in. per foot. Referring to Fig. 1, the front end of the screen is supported on rollers, and the back end on a central pintle, while it is driven by a pair of bevel gears.

Generally it is best to start the calculations at the end furthest away from the driving gear, so that we can add to this as we proceed, and so arrive at the total power required when we finish up at the driving end. We will, therefore, first calculate the power required to overcome the friction of the idler rollers at the front end. To arrive at this we must know the weight of the revolving parts of the screen, and the maximum weight of coal which will be in the screen.

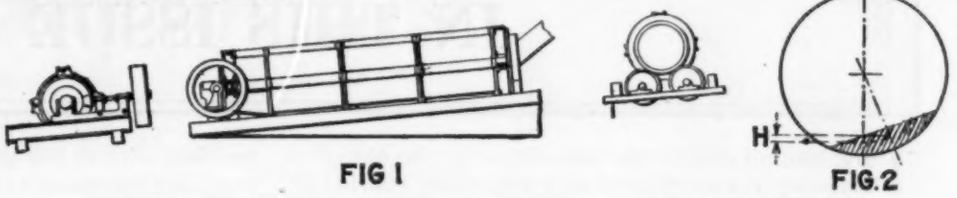


FIG. 1. REVOLVING COAL SCREEN, SHOWING BEARINGS AND DRIVE.
FIG. 2. ACTION OF COAL IN SCREEN

The inclination of the screen being 2 in. per foot, the speed of the coal through the screen will be 2 ft. per revolution, or 32 ft. per minute. The maximum delivery specified being 100 tons per hour, or 1.7 tons per minute, the amount of coal in the 20-ft. length of the screen will be $1.7 \times 20/32$, or practically one ton. Taking the weight of the revolving parts of the screen as 12,000 lb., we have a total weight of 14,000 lb. to support on the bearings. It will be near enough for our purposes to assume that the weight is equally distributed between the two ends of the screen, and this gives us 7,000 lb. as the weight on the two idler rollers, acting vertically. The resultant re-action of the rollers will be 4,800 lb. on each, this being determined by the triangle of forces.

Taking the co-efficient of the bearings to be 0.15, the friction load at the surface of the shaft will be $4{,}800 \times 0.15 = 720$ lb. This amount is reduced by the leverage of the roller, in the ratio of the diameter of the roller to the diameter of the shaft. Taking this as 5 to 1, we have 144 lb. pull required at the periphery of the roller, or 288 lb. for the two rollers at the periphery of the screen.

The velocity of the periphery of the screen being 300 ft. per minute, the horsepower required will be

$$\frac{144 \times 2 \times 300}{33{,}000} = 2.6 \text{ hp.}$$

To this must be added, the friction load due to the pintle bearing at the rear end, which will be $7{,}000 \times 0.15 = 1{,}050$ lb. This load acts on the surface of the pintle shaft, which will have a peripheral velocity at 16 revolutions per minute of about 100 ft. per minute. Converting this into horsepower we get

$$\frac{1{,}050 \times 100}{33{,}000} = 3.2 \text{ hp.}$$

The coal in the screen has to be raised to that height at which it will commence to slide back, as shown in Fig. 2, which involves supplying power to raise 1.7 tons per minute through a height H. In a 6 ft. diameter screen, the angle required to cause the coal to slide being 20 deg., the height H will be 0.17 ft., and the horsepower

$$\frac{3{,}400 \times 0.17}{33{,}000} = 0.017 \text{ hp.}$$

To this must be added the friction between the coal and the screen. Taking a co-efficient of friction of 0.2, the horsepower required will be

$$\frac{2{,}000 \times 0.2 \times 300}{33{,}000} = 3.6 \text{ hp.}$$

Adding together these amounts, we get a total of 9.42 hp. to be transmitted by the bevel gears. As the efficiency of the bevel gears will be about 90 per cent, the power required at the pinion shaft will be $\frac{9.42}{0.9} = 10.5$ hp. The belt drive having an efficiency of 95 per cent, the actual total power required at the pulley will be $\frac{10.5}{0.95} = 11$ hp.

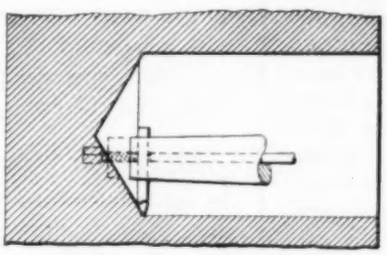
In some classes of machinery it will be necessary to calculate the additional power required to accelerate the moving parts at the starting up of the machine. Also for machinery that is to be operated in exposed places, where the lubricating oil may become frozen, it will be necessary to use much higher coefficients of friction to allow for the extra power needed.

The point I wish to emphasize is that unless some calculation is made to determine the power that will be absorbed in friction, the power allowed is very likely to be much under the actual requirements, so that if the driving gear is designed without careful estimation of the friction it will most likely prove to be too weak to stand up.

A Boring Bar of Merit—Discussion

BY JOHN HOUSSMAN

In answer to the article by E. Lytton Brooks, on page 113 of *American Machinist*, the sketch of the tool is correct—with three minor exceptions. The wall at the end is too thick. There is no need to have it thicker than ¼ in. and this is the reason for case-hardening. The wedge is a round rod, filed flat on one side and fitting in a drilled hole. The hole for the central rod is, of course, drilled from the end, which the sketch fails to show. This tool was never intended for bottoming holes, a small clearance being required, as pointed out previously. As seen from the attached sketch, the end of the tool enters the drill-point depression, requiring less room than would a setscrew, as indicated by the dotted lines. The sizes of drills used in oil-well shops range up to No. 5, so that the big drill-point depression is not an exaggeration.



BOTTOM CLEARANCE OF BORING BAR IN LARGE DRILLED HOLE

A "blind hole," as I understand it, is one that does not go through the metal, for instance, a hole for a stud. A time when a bar of this type is appreciated, is when a casting is chucked too close to the chuck-face to clear the setscrew on the ordinary boring tool.

IN THIS ISSUE

THE leading article this week takes up the design of traveling cranes from a very important standpoint, that of safe operation. The traveling crane is probably second only to the motor truck in its potential ability to figure in serious accidents. Built, as it is, to carry heavy loads of solid or sometimes molten metal through busy shops or foundries, serious harm may result from the failure of any of its numerous working parts. Mr. Nicolaas Prakken, the author, takes up in turn the girders, bridge machinery, trolley and switches and points out the ways in which they should and should not be designed. In conclusion he mentions briefly a typical transfer crane installation and brings out the prevalent bad practice of over-loading traveling cranes. We might compare the traveling crane to the motor truck in this instance also, as very few owners or operators of motor trucks have not been guilty at some time of badly overloading them. In either case this practice is bound to shorten the life of the mechanism as well as to create dangerous conditions for those who happen to be in the vicinity.

The description of a high production French ship building plant, which begins on page 766, has been given the title, "A French Hog Island." The particular plant referred to does not turn out nearly so large a product as did our own Hog Island yard during the war, but the methods employed in its operation are very significant of the advance made in France in developing large scale production. In his article Mr. Carpenter also takes up the recovery of French industry since the war and the development during the war of big armament and munition plants that must now be transformed to peace time production. Living in Paris, as he does, the author is in an excellent position to draw an accurate picture of French industrial life. We hope to have more from him in the near future.

The second of the articles on tool engineering by Dowd and Curtis starts on page 770. Having cleared the field of general considerations in their introductory article last week the authors get down this week to details of drill jig design. For the benefit of the novice in jig and fixture design the first part of the article is devoted to a study of the method of analyzing a jig problem. Then the points to be considered in designing a jig are given as follows: "Method of locating the work so that it will be machined in a uniform manner, the clearance between the jig body and the work, chip clearance, accessibility in setting up and removing the work, distortion in clamping, etc." The rest of the article is devoted to a detailed discussion of the first of these considerations—the method of locating the work

The next article is our railroad shop article for the issue. The material for it was gathered in one of the big shops near Pittsburgh by S. Ashton Hand, the efficient conductor of our editorial information bureau. Mr. Hand used to drive a locomotive a good many years ago and he has not forgotten how to appreciate the fine points in the design of our modern and near-modern motive power. The principal things discussed here are the repairing of broken cylinders and some ingenious gages used for gaging various parts that are most often handled in a locomotive repair shop.

The current installment of our "Program of Apprenticeship" series deals with the training course at the plant of the Packard Motor Car Co., of Detroit. These courses must of necessity cover a wide field, as the Packard people train not only the young apprentices but also technical graduates and a number of truck salesmen.

The second of Joseph K. Wood's articles on the design of helical springs begins on page 780. In addition to deriving various formulas, he takes up the effect of corrosion, electroplating and mechanical and heat-treatment. Something is also given on the constitution of various alloys used for spring manufacture.

Part VI of Ellsworth Sheldon's series on magnetic chucks follows on page 787. This week Sheldon takes up the chuck built by the Heald Machine Co. Unfortunately, there was too much to fit into one issue so we had to split it and will continue it next week.

In our News Section, on pages 800f and 800g, are found first-hand accounts of two important conventions of the past week; the fifth annual meeting of the American Gear Manufacturers' Association, held at Cincinnati, Ohio, and the ninth annual convention of the Chamber of Commerce of the United States, held at Atlantic City, N. J.

Coming Features

Our next issue will be devoted in large part to the several series in which we suffered something of a setback when we eliminated them entirely from our April 21 issue.

Part IX of Metal Cutting Tools will be concluded. We had expected to finish it in this issue but a wealth of other material prevented. It is concerned with the design and grinding of form milling cutters.

Dowd and Curtis go on with drill jig design, in the third installment of Tool Engineering, with particular attention to clearance for work and chips, provision for wear on locating surfaces, and the setting up and removing of work.

Another far Western railroad shop article will be contributed by Frank A. Stanley. This one discusses machining operations on locomotive connecting rods.

EDITORIALS

Reducing Losses—With Improved Machinery

THE average industrial plant in this country is facing the unpleasant necessity of running at a loss. The owners would save money—for the time being—by closing down altogether. But fortunately the managements are farsighted enough to realize the ultimate disaster likely to result from such a step.

Smooth-running organizations in office or shop do not grow overnight and discharged men are not always considerate enough to wait around in idleness until their services are needed once more. They usually go and "hunt themselves another job." The cost of breaking in new men has been commented upon so many times that it is superfluous to enlarge on it.

Everyone will admit that modern machinery will reduce costs and enable a manufacturer to undersell his competitors and at the same time make a fair profit. But when no sales are being made and he wants to hold his organization together this factor shrinks in importance before the vital need of keeping losses as low as possible.

For the present, then, until business becomes brisk, it will be well to give careful thought to the ability of the best of modern tools to keep your losses down to the irreducible minimum.

Business Insurance

IN SPITE of the business depression due to the necessity of drastic readjustment there have been very few business casualties in the machine-building industry. But this should not lull us into a feeling of security which is liable to be rudely jarred when business begins to pick up in earnest.

Just at present the question of prices and costs is not so vital as it will be a little later. Buyers are still holding off and orders are not being placed, regardless of price reductions. But when buying starts, and this promises to be in the near future, the real competition will begin, and when it does, the hopes of those who are not prepared will go a-glimmering.

Now is the time to look facts squarely in the face. We must not make the mistake of thinking of business as it existed from 1915 to 1920 as normal and expect to equal it this year or next. It is far safer to take 1913 as a basis, and add whatever percentage seems right to tally with the natural increase of the country. But forget the past five years as a yardstick of normal business.

There is business ahead, lots of it. But it will go to those who are prepared to fight for it and to meet severe competition. Old methods and old ideas of management will not suffice. Those who survive must be prepared to produce at a lower cost than ever before.

This is a case where each concern must carry its own insurance against accident. Management must be prepared against casualties and the mortality may be higher than we think.

There is only one form of insurance that will count in the days to come, and this is within the reach of every live manager. Modern machine equipment is the only safe insurance policy against business mortality. The shop with out-of-date equipment cannot meet the competition that is to come and this is true regardless of the kind of business. Production costs must go down. Some of the decrease may come from lowered wages but the manager who depends on this factor alone is doomed.

Now is the time to put your plant in order, to put in the best machinery that can be had. This is the best preparation for the future, and of itself will help to start business on its upward way. Study the question of costs and the new machinery that will help you reduce them. Then begin to get ready for business when it comes, by being prepared to handle it at the lowest cost.

And in considering different phases of your business, the handling of material, both in and out of the shop, should not be overlooked. Inter-shop trucks and motor trucks have both come to be a part of the equipment of every large plant.

Insure your business against financial accident by equipping it with modern machinery. And do it now!

Several Good Signs

ONE of the encouraging signs of the times is the building of machine tools for the manufacture of huge turbines for hydro-electric work. Some of the big builders of electric machinery are increasing their shop equipment with the addition of some of the largest machines ever built in this country. Need we ask for better evidence of their faith in the future business of the country?

Makers of such supplies as hangers and couplings also report a decided increase in orders and inquiries. These supplies go into a great variety of industries and are going to various parts of the country. They all indicate a return of confidence which is the backbone of good business.

A large and well-known maker of motor trucks also reports an increase in orders and inquiries. The orders will bring the output for May up to 500 trucks, varying from 1½ to 7½ tons capacity. This makes a remarkably good output for one builder and shows an increasing interest in motor truck transportation.

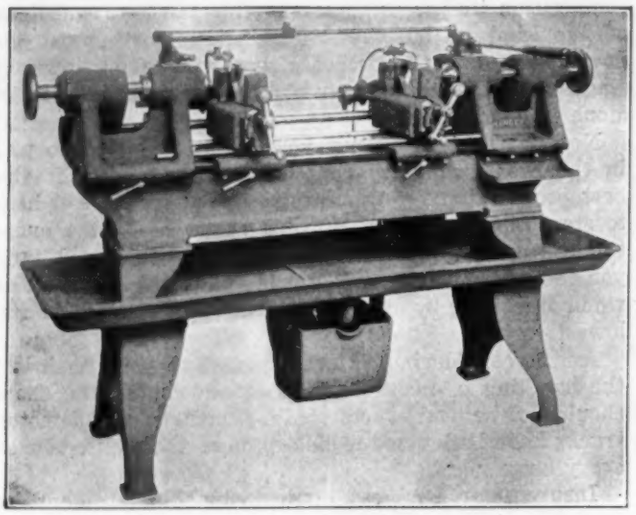
This is about half the maximum output ever secured under the stress of war and after-war demand, which means that it is much more nearly a true normal than appears on the surface. And when we consider that the motor truck is distributed among all the industries instead of being confined to any one line or to any special section of the country, the increased demand is a much more healthy sign than it may appear at first sight.

With more electric power available at lower costs, and more factories equipped with modern transmission machinery, more machine tools and other machinery are sure to be needed a little later. We have started on the up-road!

Shop Equipment News

Hendey Double-Head Centering Machine

The Hendy Machine Company, Torrington, Conn., has brought out the double-head centering machine shown in the illustration. Instead of the usual belts



HENDEY DOUBLE-HEAD CENTERING MACHINE

Specifications: Front taper bearing of spindle, 1⅞ to 2⅛ x 5¾ in. Length of bed, any number of feet from 5 to 12. Capacity between spindles with 5-ft. bed, 30 in. Maximum distance vise to support, 38 in. Capacity of vise, ⅛ to 4 in. Pulley diameter, 12 in. Countershaft speed, 800 r.p.m. Spindle speed, 1,200 r.p.m. Floor space, with 5-ft. bed, 71 x 23 in. Net weight with 5-ft. bed; single spindle, 1,350 lb.; double-spindle, 1,550 lb.

driving direct to the spindles from an overhead drum a single belt drives a countershaft running on ball bearings and supported on brackets extending from the rear of the bed. From the countershaft the power is transmitted to the spindles by means of silent chains.

The front journal of each spindle is tapered and provided with ring-nuts, by means of which the wear of the bearing may be compensated for. The bearing is a bronze sleeve sliding in the cast-iron bracket of the head. Rack teeth are cut directly into the metal of the sleeve. A ball thrust bearing takes the thrust of the drills. The rear bearing of each spindle is a steel sleeve running on two ball bearings. The inner end is formed into a sprocket to receive the drive chain, the thrust of the drive thus being sustained by the ball bearings and not coming upon the spindle. The spindle is splined to the sleeve and is free to move endwise through it.

The feed lever is not connected directly to the pinion shaft, but a powerful compensating spring is interposed so that, although one spindle is brought against its stop, the lever may still be moved forward until the other spindle is against its stop. One feed lever operates both spindles, insuring that both drills reach the full depth for which they are set.

The spindles are fitted with spring collets to hold the centering tools, and a spring-operating locking pin is provided to prevent the spindles from turning while tightening the collets. This pin must be held in engagement by the pressure of the operator's finger, and is automatically withdrawn when the pressure is released.

The work-holding jaws are operated in unison through the medium of bevel gears on a splined shaft; and here again the compensating feature is used, so that both sets of jaws will grip with equal force.

Once set to give the proper depth of countersink in each end of a piece of standard length, and the spindle stops adjusted, the machine will continue the countersink evenly and to standard length, even though the pieces themselves vary slightly in length. This is accomplished by leaving the gripping jaws just slack enough to allow the work to float, and bringing up the drills by moving the feed lever until the work adjusts itself endwise between the drills, and then finally tightening the jaws.

The machine is provided with a coolant tank, pump and hose to each drill, although the single-spindle machine is fitted with an oil pot only. Individual motor drive may be used, the motor being mounted on the rear of the bed, and connected to the drive shaft by a chain. A ½-hp. motor is said to be sufficient to operate the machine.

"Economy" 14-Inch Geared-Head Motor-Driven Lathe

The Rockford Lathe and Drill Co., Rockford, Ill., has developed a geared head and motor-drive for its "Economy," 14-in. swing, quick-change engine lathe. The illustration shows only the headstock end of the machine, the lathe itself being similar, except for the drive and the head, to that described on page 771, Vol. 51, of the *American Machinist*.

"ECONOMY" 14-IN. GEARED-HEAD MOTOR-DRIVEN QUICK-CHANGE LATHE

The headstock is driven by a single pulley and provides twelve spindle speeds in geometrical progression with the use of but thirteen gears. These gears are of large diameter, wide face and coarse pitch, are cut from solid steel and run in an oil bath. The spindle and all shafts are of high-carbon steel. The spindle has a special thrust bearing consisting of alternate collars of hardened steel and bronze. The bearings are of bronze and are equipped with sight-feed oilers. The quick-change gear box provides thirty-two changes of threads and feeds obtained through sliding steel gears and hardened steel clutches.

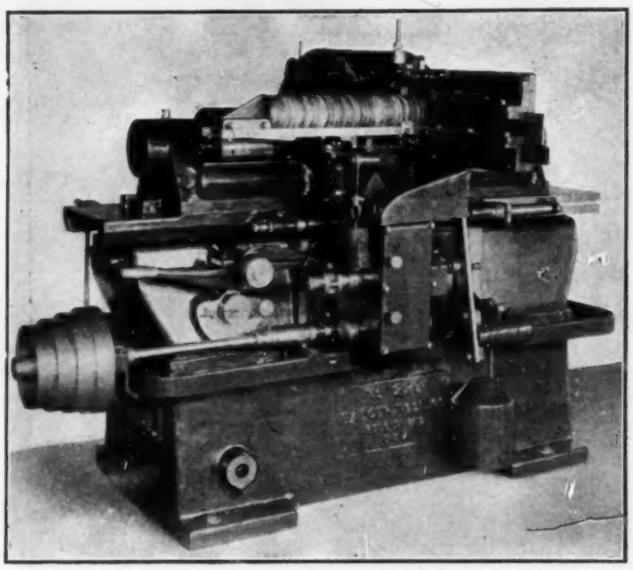
The motor may be of any standard make, preferably of 1½ or 2 hp. with a constant speed of not more than 1,200 r.p.m. It is mounted on a detachable plate securely

fastened to a base cast integral with the cabinet leg, and driving through a belt kept at the proper tension by means of an adjustable idler pulley. This construction eliminates the necessity of removing the motor should occasion arise to lift the cover of the headstock for inspection or adjustment, such as would be the procedure where the motor is mounted directly on the headstock. The motor may, however, be placed on the floor, wall or ceiling and belted direct to the headstock pulley. As the motor is of constant speed, no elaborate electrical control is necessary, starting and stopping being handled by a shifter-bar running the full length of bed, and operating a double-end friction clutch in the head stock.

Specifications: Swing; over ways, 14½ in.; over carriage, 8 in. Length of bed, 6, 8 or 10 ft. Pulley diameter, 10 in. Width of belt, 3 in. Speed of pulley, 400 r.p.m. Cuts threads, 4 to 56 per in. Feeds, 18 to 252 per in. Spindle speeds, 15 to 400 r.p.m. Size of tool, ½ x 1 in. Weight with 6-ft. bed; net, 1,725 lb.; domestic shipping, 1,973 lb.; export, 2,175 lb. Export, box, 48.6 cubic feet.

Badger Automatic Piston-Ring Grinding Machine

The Badger Tool Co., Beloit, Wis., has recently placed on the market the automatic piston-ring grinding machine shown in the illustration. The machine consists



BADGER AUTOMATIC PISTON-RING GRINDING MACHINE

of the company's No. 220 grinding machine fitted with special attachments for handling the rings. The function of the machine is to rough-grind the parallel sides of individually cast rings, bringing them down to approximate size preparatory to the finish-grinding operation on a high-precision grinding machine. It is stated that the machine can grind an average of 8,000 rings per 10-hr. day, with but little variation in size. One man can operate two machines. All warp or twist in the casting is said to be removed, producing a very flat rough-ground ring, and ring breakage being greatly reduced.

The illustration shows a front view of the machine with some hoods and guards removed to show the construction. The hopper track holds one hundred ring castings, and can be extended to receive two hundred if desired. The column of rings is backed up by a pusher attached to a cable and weight. A reciprocating ram, driven by a cam, arm and weight, forces one ring at a time between the two grinding wheels held in chucks. Guide bars are placed above and below the ring. The grinding wheels are automatically opened just as a ring enters at the front, and at the same time a finished ring leaves at the back, falling into a chute, and from thence into a box or suitable container.

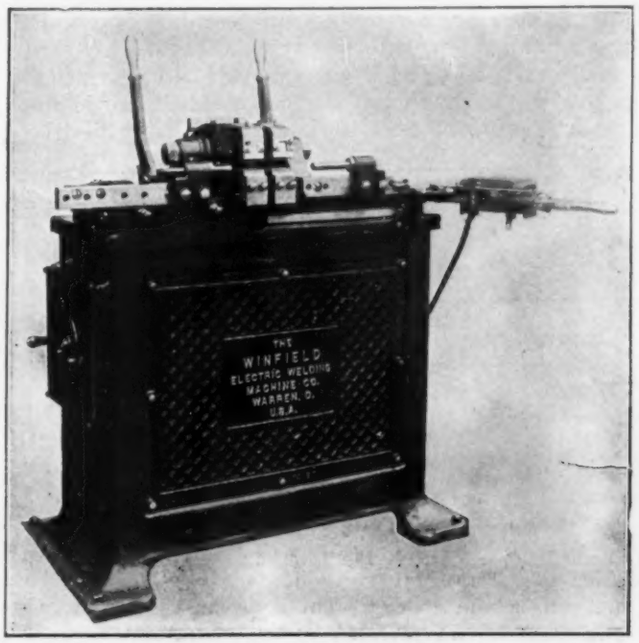
The ring castings are made to pass across the entire grinding faces of the opposed cupped wheels, which are 18-in. in diameter and have 5-in. center holes. The wheels are brought together by means of a lever and weights, the pressure being varied by adding or removing weights. The positive micrometer stop screw is located at the front. A wheel-truing attachment is furnished, and the wheels can be dressed rapidly and without disturbing the setting. The machine is adjustable to take rings varying in diameter from 2¾ to 4½ in., and in thickness from ⅛ to ½ in.

The countershaft is supplied with an extra cone pulley for driving the automatic parts of the machine. Four speeds are obtainable, so that small sized rings can be put through faster than larger sizes. A throw-out clutch is placed in the drive shaft just to the left of the reduction gear case. All moving parts such as gears, cams, rollers and slides are covered with guards, for protection against dust or injury to the operator. All bearings are bushed. The machine is furnished for either dry or wet grinding. The complete equipment weighs 4,500 lb., and 10 to 15 hp. are required for capacity operation.

Winfield Type-B6 Butt-Welding Machine for Drills

The illustration shows the Type-B 6 butt-welding machine recently placed on the market by the Winfield Electric Welding Machine Co., Warren, Ohio. The machine is self-contained, and is intended for flash welding high-speed-steel drills, handling stock from ¼ to ¾ in. in diameter.

A 15-kw. transformer and a 6-step self-contained regulator are provided. The switch is located on the hand lever and is operated semi-automatically. It is set by a thumb latch on the lever and is automatically tripped after the weld is made. The lower dies are



WINFIELD TYPE-B6 BUTT-WELDING MACHINE FOR DRILLS

copper and the upper dies tool steel. Water circulates through all copper terminals, it not being necessary to break the water connections when changing the dies.

The work is clamped by hand in dies located at the front of the machine, and a single toggle hand lever is used for upsetting the weld. The left-hand slide is adjustable to regulate the amount of take-up in welds, and also for aligning the work. Adjustable stops are provided for backing up the work.

The machine is said to be so constructed that the small particles formed by the flash are prevented from getting into the movable parts and bearings. The upsetting slides are faced with hardened steel plates. All movable bearings have hardened steel bushings and pins, and are protected by felt wherever possible. The dies are set at the front of the machine so that the flash is away from the bearings and slides. The clamping levers are placed back of the dies and clear of the flash, and clamp the work by means of hardened steel cams, no toggle being used.

One set of four welding dies arranged for the work to be welded is included. The floor space is 42 x 40 in., the height of the dies, 36½ in., the height over-all 56 in., and the weight approximately 1,000 pounds.

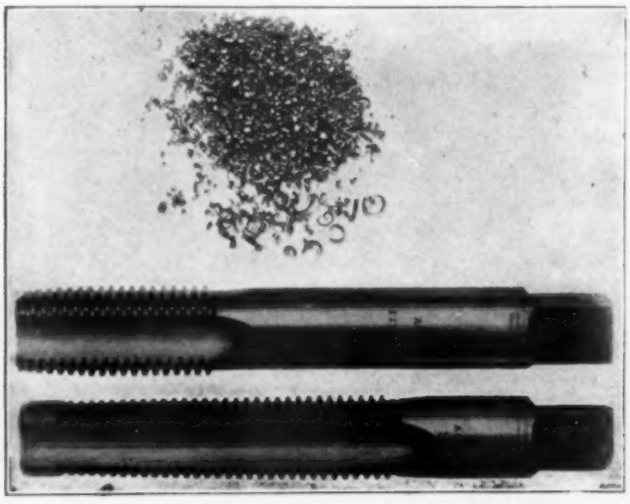
Bath "Easy-Cut" Ground Taps

The accompanying illustration shows a roughing and a finishing tap lately placed on the market by John Bath & Co., Inc., 8 Grafton St., Worcester, Mass.

The roughing tap is provided with a pilot to square it and keep it concentric with the hole. The first few teeth are similar to the U. S. form but are gradually blended into the Acme form. Alternate sides of the teeth are relieved so that only one side of each tooth does any cutting. It is said that the teeth have the cutting action of side tools, rather than that of a series of broad-nose tools, as is the common practice, and roll the chips out easily into the clearance of the flutes. There being no jamming of chips in the flutes to choke the tap, the effort exerted in hand-tapping is greatly reduced and the danger of breakage is minimized, resulting in increased life. The tap being tapered, the cutting is distributed over the full length.

The finishing tap, besides having the teeth relieved alternately on the sides, is ground after being hardened to correct any distortion of the lead and helix angle due to the hardening process. It is claimed that while the tap is essentially a production tool, it will produce work in conformity with the close fit tolerances laid down by the National Screw Thread Commission. For all ordinary sizes of taps with 60-deg. threads, the use of a roughing tap is said to be unnecessary, as the thread can be started and completed with a single tap.

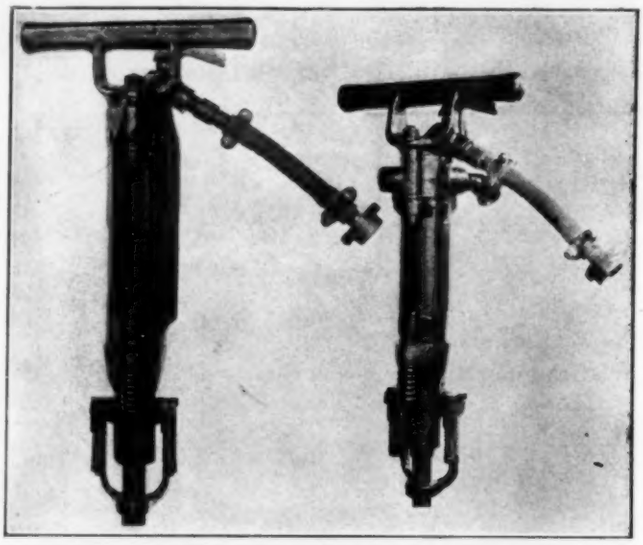
The character of the chips made by these taps is shown in the illustration. "Easy-Cut" taps are available in U. S. Standard and National coarse, and S. A. E. or National fine thread sizes; also in Lowenhertz or International Metric sizes and in special diameters and pitches.



BATH "EASY-CUT" TAPS AND THEIR CHIPS

Ingersoll-Rand Pneumatic Paving Breaker

The Ingersoll-Rand Co., 11 Broadway, New York, N. Y., has recently placed on the market a pneumatic paving breaker. The device is made in two types, BC-25 and CC-25, both shown in the illustration, the former type being intended for operation with higher air pressure than the latter. The device is intended primarily for the breaking up of asphalt and concrete pavement, but is adaptable to a wide range of work. Its outdoor application is the cutting of ditches in the repairing and repaving of streets, the tool being used chiefly in conjunction with a portable air compressing outfit. For indoor work, as for tearing up the pavements in shops, it can be connected directly to the air line of the plant.



TWO TYPES OF INGERSOLL-RAND PNEUMATIC PAVING BREAKERS

Specifications: Made in two types, BC-25 and CC-25. Air pressure recommended, over 80 lb. and under 80 lb., respectively. Size of hose, ¾ in. Size of steel, 1⅛ in. solid hexagon. Length of stroke, 4 in. Bore of cylinder, 2 in. and 1⅞ x 2¾ in., respectively. Length overall, 24 in. and 25 in. Weight, 58 lb. and 68 lb.

The tool is said to be simply and sturdily made of steel, most of the parts being drop forgings. The handle is of T-shape, being sand-blasted so as to afford a good grip for the operator. The throttle valve is controlled by means of a trigger. The joints are bolted instead of screwed, the working parts being easily accessible. The spring connections provide for the absorption of undue shock.

The steel or cutting point is secured to the device by means of holders, so that the operator may lift the steel with the drill. Steels having collared shanks are employed, a chisel-edged tool being used for cutting asphalt, and a moil point for breaking concrete. The

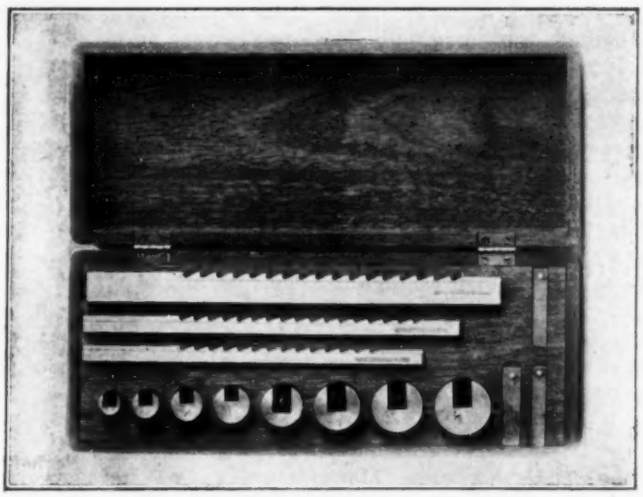
BC-25 breaker employs a "butterfly" valve, the action being very rapid, and all opening passages being large so that small particles of dirt entering the machine are blown through and out the exhaust. The CC-25 machine uses a differential piston, which controls the admission and exhaust of the air; and an exhaust release valve allows the expansion of the air to be effectively utilized.

Lapointe "Handy" Keyway Set

The J. N. Lapointe Co., New London, Conn., has brought out a broaching set intended to meet the requirements of manufacturers and jobbers who have a comparatively small number of parts in which keyways are to be cut, the quantity not being sufficient to warrant the installation of a broaching machine.

The set consists of three broaches to cut $\frac{1}{8}$ in., $\frac{3}{16}$ in. and $\frac{1}{4}$ in. keyways, respectively, and eight bushings for holes ranging in size from $\frac{5}{8}$ up to $1\frac{1}{2}$ in. in diameter. Liners are furnished for each broach, so that two passes of the broach may be used to cut a keyway. The set is packed in a wooden box with a separate receptacle for each part, so that the set may be kept together and protected against injury. With this set twelve combinations may be obtained, and keyways cut in holes up to 2 in. long.

The broaches may be used in connection with any standard arbor press, the operation being very simple and not requiring skilled or experienced help. The keyways are cut to exact size, and the location of the keyway with respect to the axis of the hole is determined by the guide bushing. The broaches are of standard high-carbon steel, and they, as well as the bushings, are ground all over after hardening.



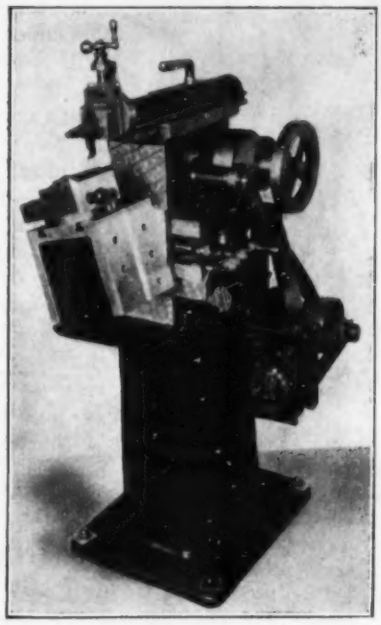
LAPOINTE "HANDY" KEYWAY SET

Rhodes Improved Shaper

The Rhodes Manufacturing Co., Hartford, Conn., has recently added a swivelling knee to the shaper which it manufactures. Also, the shaper has been made an entirely independent unit by casting suitable brackets on the column and mounting a $\frac{1}{2}$-hp. motor, with a starting box so located as to be within easy reach of the operating position. The machine is shown in the accompanying illustration.

To provide against injury to the machine or motor by accidental stalling, a countershaft is interposed between the motor and the machine, being driven by a Whitney chain from the motor and, in turn, driving the shaper through a $1\frac{3}{4}$-in. leather belt running on three-step cones.

The knee is arranged to swivel to any desired angle, the face of the saddle being graduated to facilitate setting. A closely fitting pin determines the zero setting, so that after using the knee at any angular setting it may be brought back to the vertical position with ease and certainty. The knee is finished accurately square in all directions by means of a jig, used in connection with a a grinding machine, that provides for the finish grinding of all surfaces at one setting. All parallel surfaces on the tool-slide are also finish-ground in a jig, rendering it easy for the shaper operator to apply a square or bevel protractor in any convenient position without danger of error arising from inaccurate surfaces.



RHODES IMPROVED MOTOR-DRIVEN SHAPER

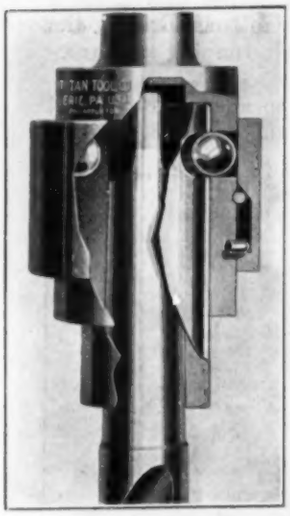
The specifications for the machine are the same as heretofore, except that a slightly larger floor space is required for the motor-driven machine. The stroke is $7\frac{1}{2}$ in.; the traverse movement of the saddle, 9 in.; the vertical movement of the table, 7 in.; the vertical movement of the tool-slide, $2\frac{1}{2}$ in., and the maximum distance from the upper surface of the table to the ram is $8\frac{7}{16}$ in. The vise jaws are $1\frac{5}{8}$ x 5 in., and the vise opens $3\frac{1}{4}$ in. The weight of the machine complete is approximately 650 lb., and the floor space required is about 22 x 32 in., including the overhang of the motor.

Titan Quick-Change Drill Chucks

The Titan Tool Company, 26th and Holland Sts., Erie, Pa., has recently placed on the market a line of quick-change drill chucks. The chuck is of the collet type, collets being provided to fit either straight-shank or taper-shank drills, the latter being illustrated. The speed of operation of the chuck is emphasized, it being necessary to use only one hand to insert or to remove the collet carrying the drill.

On taper-shank drills the tang projects through the upper end of the collet, so that the drill may be removed by merely striking the end of the tang, no drift or key being necessary. A special type of collet is provided for use with broken-tang drills, so as to give a positive drive. The chucks for taper-shank drills are made in sizes from No. 0 to 5, so that any taper shank drill, counterbore, or reamer may be held.

It is said that a positive drive is provided for straight-shank drills, so that scored shanks are eliminated and the drill will continue to cut throughout a job to the



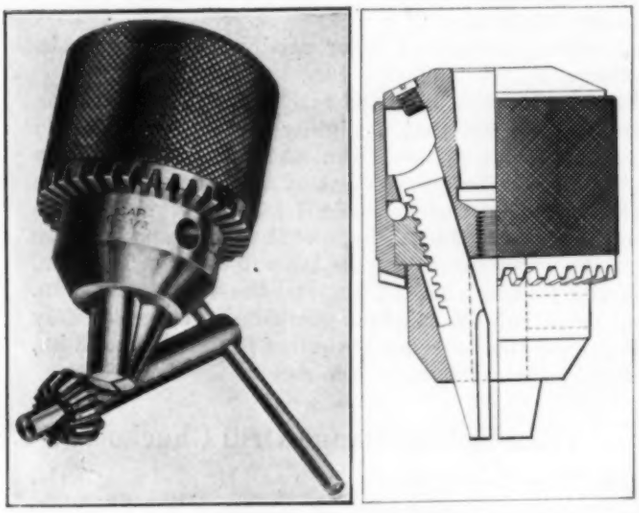
TITAN QUICK-CHANGE DRILL CHUCK

depth to which it has been set. Because of the fact that the collet is securely held, very close positioning of the hole may be done, which makes the tool particularly adaptable for multiple drilling. The chuck for straight-shank drills is built in two sizes, the No. 000 chuck having a capacity up to $\frac{5}{16}$ in. drills, and the No. 00 up to $\frac{1}{2}$ in. drills. Bushings can be furnished for all decimal, letter and fractional sizes of drills within the capacity.

The chucks are made of high-carbon steel and are hardened and ground. Because of the fact that the ring is spring actuated, it is possible to operate the chuck in any position, so that either horizontal or inverted drilling may be performed. Speed and safety of operation, as well as accuracy of work, are claimed for the chucks.

Jacobs "Super" Drill Chuck

The Jacobs Manufacturing Co., Hartford, Conn., now has ready for the market an improved form of its drill chuck, called the "Super-Chuck." In principle it



JACOBS "SUPER" DRILL CHUCK

is the same as the former design of Jacobs chuck, but it has been redesigned to reduce the weight relative to the capacity and at the same time to increase the strength of the parts and give it a stronger grip. The accompanying illustration shows the appearance of the chuck, as well as the interior construction.

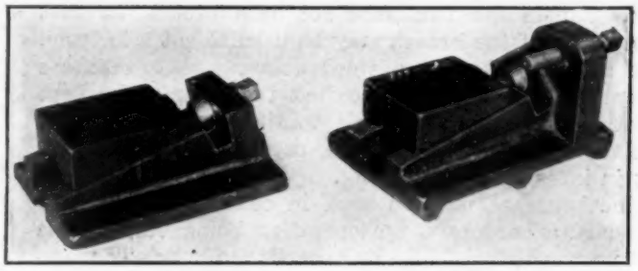
A ball thrust-bearing has been added to reduce the friction of the sleeve in tightening the chuck on a drill, and the lead of the thread on the nut and jaws has been increased, giving the effect of a coarser pitch and increased cross-section of the thread, which results in increased resisting power at this point.

The body of the chuck is made of a spcial grade of steel, deeply casehardened, and the taper hole for the shank is ground after hardening. A large size hole through the body permits the passage of long rods through the chuck. This central hole is threaded and fitted with a correspondingly threaded plug which, while giving the effect of a solid body, may quickly be removed with a screwdriver whenever the chuck is to be used for holding long pieces. An oil hole in the back of the chuck body, closed with a threaded plug that is removed by means of a screwdriver, provides means for lubricating the working parts.

The chuck is made in seven sizes, giving a range from 0 to 1 in. capacity. The smallest size, which holds drills from 0 to $\frac{1}{4}$ in., weighs 7 oz., and the largest size, with a range of from $\frac{3}{4}$ in. to 1 in., weighs 6 lb. 8 ounces.

Cincinnati Leveling Wedges

The leveling wedges shown in the illustration have been placed on the market by the Cincinnati Engineering Tool Co., 4659 Spring Grove Ave., Cincinnati, O.



LEVELING WEDGES MADE BY THE CINCINNATI ENGINEERING TOOL CO.

The wedges were originally developed for use on planers, but it is said that, due to the accuracy of the adjustment and the conveninece, they can be used successfully on all types of machines where a high degree of accuracy is to be maintained. The angular surfaces are machined, as well as the top of the wedge. The fine pitch screw allows accurate adjustment.

The blocks are furnished in two types, the plane leveling wedge and the abutment block, which has an additional screw to press against the foot of the machine and to serve for moving it. The blocks ordinarily set in concrete. For merely leveling, the plain wedge is used. The abutment block also serves for positioning and holding the planer or other machine.

Anderson Hand Scraper

The Anderson Bros. Manufacturing Co., Rockford, Ill., makes the hand scraper shown in the illustration. The tool is an outgrowth from the development of pneumatic scrapers, since it was found necessary to obtain a special alloy capable of withstanding severe scraping service. This steel is used for the blade of the hand scraper; and it is said that it takes a greater hardness, holds a keener edge, does not scratch, and that one blade lasts as long as four ordinary hand-forged

ANDERSON HAND SCRAPING TOOL

scrapers. The body is of a tough steel. The clip is notched on the inside to receive and hold the blade in place, and a lug prevents the blade from slipping back. This lug causes the clip to automatically tighten when pressure is applied.

The British and the American Inch Identical*

A Reply to a Statement to the Contrary Appearing in the European Edition of the American Machinist

By C. C. Stutz
Secretary, American Institute of Weights and Measures.

OUR attention has been called to some statements contained in an article written by Sir J. E. Petavel, director of the National Physical Laboratory, which recently appeared in your publication (issue of Jan. 8, 1921).

These statements are evidently based on widely circulated reports which nevertheless are contrary to the facts. Our object in sending you this communication is to correct these erroneous impressions and thereby avoid wrong deductions.

Sir J. E. Petavel says:

"In America the International Meter is accepted as the primary standard of length, and the yard is defined by the relation,

39.370000 inches = 1 meter,

an American inch of course being taken as 1/36 part of this American yard. Now the relation between the Imperial Standard Yard and the International Meter is

39.370113 inches = 1 meter.

Consequently the U. S. A. inch is longer than the inch as used in Great Britain by nearly three millionths of an inch."

This is a great mistake. There is no difference between the inch in the United States and the inch in Great Britain.

The United States law of 1866 defines the meter in terms of the inch, the equivalent being 39.37 inches. This inch is the inch of England, which is thus made the fundamental standard of the United States by statute law, as it has been under common law since the first English settlement in 1607.

To make this perfectly clear we shall quote the law on this subject. To begin with we find the following passage in the Constitution of the United States: "The Congress shall have power to . . . fix the standard of weights and measures."

We quote the metric law as enacted by Congress, July 28, 1866. (From Federal Statutes annotated, Vol. 9, page 1401.)

(11) Standard Weights and Measures.

Sec. 3569 (Use of the Metric System authorized) It shall be lawful throughout the United States of America to employ the weights and measures of the metric system; and no contract or dealing, or pleading in any court, shall be deemed invalid or liable to objection because the weights and measures expressed or referred to therein are weights and measures of the metric system.

Sec. 3570 (Authorized tables of Weights and Measures). The tables in the schedule hereto annexed shall be recognized in the construction of contracts, and in all legal proceedings, as establishing in terms of the weights and measures now in use in the United States, the equivalents of the weights and measures expressed therein in terms of the metric system; and the tables may be lawfully used for computing, determining and expressing in customary weights and measures the weights and measures of the metric system.

MEASURES OF LENGTH.

Metric denominations and values		Equivalents in denominations in use
Meter		39.37 inches
Decimeter	1/10 meter	3.937 "
Centimeter	1/100 meter	0.3937 "
etc.	etc.	etc. etc.

To bring out more fully the intent of section 3570 we requote it in the following abbreviated form:

"The tables . . . shall be recognized . . . as establishing *in terms* of the weights and measures *now in use* in the *United States*, the equivalents of the weights and measures expressed therein in terms of the metric system."

Here the "inch" is taken as fundamental, the meter being expressed in terms of the inch. Clearly the object of this law was not to change our basic units but to make the use of the metric system permissible. This is further evidenced by the title of section 3569 which reads: "Use of the metric system authorizes," and by the expression in the section reading: "It shall be lawful throughout the United States of America to employ the weights and measures of the metric system."

The difference to which Sir J. E. Petavel refers is merely a difference between the bars used for comparison and results from the Mendenhall order of 1893 by which the reciprocal 3600/3937 of the legal expression 3937/3600 was ordered for comparing United States standards (39.37 inches = 1 meter and 36 inches = 1 yard).

This order is quoted on page 60 of Circular No. 47 of the Bureau of Standards, Washington, D. C., under the title: "The Metric Standards Adopted as Fundamental" and reads as far as given there:

"The office of weights and measures . . . will in the future regard the international prototype meter and kilogram as fundamental standards, in accordance with the act of July 28, 1866." (Order approved by the Secretary of the Treasury, April 5, 1893.)

This quotation undoubtedly gives the impression that the meter is for use in America the fundamental unit, unless one gives heed to the qualifying expression "in *accordance with* the act of July 28, 1866."

This act of 1866 should have been quoted in full. The title given: "The metric standards adopted as fundamental" is therefore incorrect. This order had no effect whatever on the legal length of the inch and yard. As pointed out previously, standards of weights and measures *cannot* be changed in the slightest degree except by act of Congress.

The United States Bureau of Weights and Measures in 1893, and its successor the Bureau of Standards, could legally conform to the Mendenhall order only so far as the bar used for comparison was concerned. Under the law and the Constitution the sworn duty of the officials of those bureaus was and is to treat any variation between standards resulting from the use of the reciprocal (3600/3937) of the legal meter as merely a variation between bars used for comparison, just as

*From a letter to the Editor, European Edition, *American Machinist*.

the differences between the London yard and Sevres meter or between the different meter bars are taken into account in verifying standards.

Two facts should always be kept in mind.

(1) The U. S. yard and the British yard are exactly the same and can be made to vary only by act of the British Parliament or by act of the Congress of the United States.

(2) The Act of 1866 defining the meter as 39.37 inches established a U. S. standard meter differing slightly from the standard meter accepted by the International Bureau of Weights and Measures at Sevres.

The equivalent of the International meter is taken:

as 39.370113 inches in England,

as 39.370000 inches in United States of America,

therefore the United States meter is shorter than the International meter and the difference is expressed by

$$39370000/39370113 = .99999712902\,287098$$

$$1.00000000000$$

approximately 287/100,000 millimeter,
or nearly 3/1,000 millimeter.

This question cannot be settled by asserting that the differences are negligible for ordinary measurements, and are material only when the highest degrees of precision is involved. The principle is as important in one case as in the other. If it is conceded that an order of a bureau official at Washington can change the U. S. standard of the yard to any extent whatever, no matter how slight, then the same official can change this standard or any other standard by a larger amount.

Attempts have been made in the United States through the introduction of bills in Congress to secure the acceptance of the meter as the sole U. S. standard by the authority of Congress, but these attempts so far have failed. An incident of this kind is recalled by the Ashbrook-Stratton-Thurman bill of 1907 framed by the U. S. Department of Commerce. This bill was not passed, nor have similar bills found favor.

The temperature at which a bar is declared standard is naturally of great importance. The International prototype meter is standard at 0 deg. C. (32 deg. F.). The Imperial standard yard is standard at 62 deg. F. There is no legal statement in the United States as to the temperature at which a yard is standard. Such a legal statement is unnecessary until a legal physical standard of length is adopted. This we do not have. No physical standard of length has ever been established by Congress. Thus, legally, we must go back to the British Imperial yard at 62 deg. F.

It is for this reason that bars on measuring machines are generally made standard at 62 deg. F. in the United States. According to the Act of 1866 both the "inch" bars and metric bars must be made standard at the same temperature in order that the relation between English and metric measurements made on such machines under similar conditions be in accordance with that act.

Present Conditions in the German Machine Industry

Business Very Poor But Marked by Strong Feeling of Confidence—Labor Leans Away from Radicalism—The Formation of the Big Trusts—Wage Rates

BY OUR BERLIN CORRESPONDENT

THE present situation is somewhat like that in which German industry found itself after the end of the war, when the shops were almost out of business. The mental attitude toward the present calamity is, however, entirely different. Strong confidence, entirely missing then, has returned. There are several important facts upon which this confidence rests. The labor situation is greatly consolidated, a fact which the Communistic riots in March emphasized, showing as they did that the majority of the workmen have become tired of radicalism. The spirit of antagonism between employers and employed has abated. Representatives of employers' associations and trade unions are now constantly meeting on boards formed in almost all branches of industry, to co-operate in all matters pertaining to their development.

Another helpful sign is the improving financial position of the country. The total revenue since April 1, 1920, was 100,597,000,000 marks, while the ordinary expenditure was 83,582,000,000 marks. Post and telegraph administrations have again reached a paying basis, and are now contributing to the treasury. Were it not for the large deficit of the state railroads, Germany's finances would be well balanced.

That the trade of the country is on the way to recovery is demonstrated by the increased traffic of the German harbors in 1920. In Hamburg, the traffic amounted to nearly 7,000,000 registered tons, as against 1,919,000 registered tons in 1919. This tonnage is far below the volume of pre-war times, which in 1913 was 23,500,000 tons, but the fact that of the 7,000,000 tons in 1920 nearly half were shipped during the last three months of that year shows that the traffic was rising in a steep line. It is interesting to note how the various nations share in it. Only 24 per cent of it traveled under the German flag, as against 60 per cent in pre-war times, 23 per cent under the American flag, the British and Dutch flags following with 21 and 10 per cent respectively.

That confidence has not been shaken by the present calamities is demonstrated by the fact that inquiries for new equipment have not diminished, but even increased. A firm of Berlin machine-tool dealers has received more inquiries during the first three months of 1921 than all through the preceding year. As an indication of future business, which is only waiting for the end of the present unsettledness, this is decidedly encouraging.

Some interesting data concerning the German machine building industry were given out by the president of the Association of German Machine Building Works at the inauguration of the co-operative board formed between this association and the machinists' union.

According to these data, the total annual production of

the German machine building industry averaged during the years immediately preceding the war 3,500,000,000 marks, of which 20 per cent, or 700,000,000 marks was exported. As regards the volume of exports, the German machine building industry had outrivalled all other branches of industry. As the home consumption is now greatly reduced, the percentage of exports is at present far higher, probably not much below one half of the total output. It was further said that the total export of the machine building industry of the past year exceeded that of 1913, taken ad valorem, but was less in quantity. The number of persons employed in the machine building industry, which during the war was largely increased, has now fallen back to the pre-war level, and is at present 700,000. This figure represents only the workmen of the machine building industry proper, and not those of other branches, which, like the motor-car and electrical industry, belong to it by virtue of their kindred production. One fifth of this number consists of clerical employees. Of 100 workers, 52 are skilled workmen, 27 shop-trained, and only 21 unskilled.

It is a peculiar fact that the machine building industry has so far kept outside of the "vertical trusts," combinations of works of different stages of the manufacturing process, from the coal and iron mines up to the finished product. Only in two such combinations is the machine building industry represented, one of them being the Krupp combine. Without machine building works, vertical trusts would be incomplete and therefore it is to be expected that the movement will include wider circles still. There are, however, indications that the huge combines already existant will in this respect proceed by methods of absorption rather than combination. The extent the movement has taken up to now, is demonstrated by the fact that a considerable number of works, comprising aproximately half of the whole German iron and steel production, have been welded together in fourteen huge groups. How diversified the interests are, is demonstrated by the Krupp combine. This combine comes nearest to the original conception, and its structure is, therefore, of interest. The following diagram shows how the Krupp combine is organized:

COAL MINES

Four Krupp mines—One brown coal mine—Three affiliated mines.

IRON MINES

Krupp's iron mines in the Rhineland.

PIG IRON WORKS

Stahlwerk Annen — Friedrich-Alfred Hütte — Two smaller works.

SEMI-FINISHED STEEL PRODUCTS

Stahlwerk Annen—Capito & Klein—Westph. Eisen- & Drahtindustrie (plate and sheet).

HEAVY MACHINE BUILDING

Maschinenfabrik Buckau — Krupp Works, Essen — Krupp & Fahr (agricultural machines)—Gruson Works —Shipyard Germaniawerft.

LIGHT MACHINERY

Ernemann Works—Krupp Works, Essen.

SALES ORGANIZATIONS

Six limited liability companies.

German industry is always complaining that if wages are not reduced, it will not be able to compete with foreign rivals. The following figures, taken from the official statistics, show that in two towns, Berlin and Chemnitz, the present wages per hour expressed in marks and in cents, at 1.6 cents per mark, are:

	Machinist	Machine Operator	Unskilled Worker
Berlin	M5.40 = 8.6c.	M5.20 = 8.4c.	M4.90 = 7.8c.
Chemnitz ..	M5.25 = 8.4c.	M4.85 = 7.7c.	M4.50 = 7.2c.

More than half of the workmen are now paid by piece work, at rates which make their hourly earnings about 10 per cent higher. But even taking this into account, the best paid workmen receive not more than 10 cents per hour. This cheap labor gives the Germans an enormous advantage over other countries. The German industrials are well aware of it, and this is no doubt the main source of their confidence. As long as they are able to keep the wages at the present level, or thereabouts, and the mark will remain where it is now, their position seems safe.

Another Thoroughly Vicious Compulsory Metric Bill Is Introduced

Congressman 'BRITTEN introduced the following bill in the House of Representatives, April 11, 1921, which was referred to the Committee on Coinage, Weights, and Measures. It follows the lines of the one lost in the last session but is more drastic and consequently more dangerous. Section 3 in particular merits attention.

A BILL

To fix the metric system of weights and measures as the single standard of weights and measures for certain uses.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That from and after ten years from the date of passage and approval of this Act the weights and measures of the meter-liter-gram or metric system shall be the single standard of weights and measures in the United States of America for the uses set out herein.

SEC. 2. That the national prototypes of the fundamental standards of the metric system shall be the copies of the standards known as meter numbered twenty-seven and kilogram numbered twenty, allotted to the United States by the General Conference of Weights and Measures held at Paris in 1889. These are now deposited in the vault of the Bureau of Standards of the Department of Commerce and are those which are now used and employed in deriving the values of all weights and measures used in the United States. These national representations are hereby adopted as the primary standards of weights and measures for the United States of America, and from these all other weights and measures shall be derived and ascertained.

SEC. 3. That from and after ten years from the date of passage and approval of this Act no person shall do or offer or attempt to do any of the following acts, by weights or measures, in or according to any other system than the metric system of weights and measures, namely:

(1) Sell any goods, wares, or merchandise except for export, as provided in section 12;

(2) Charge or collect for the carriage or transportation of any goods, wares, or merchandise.

SEC. 4. That from and after ten years from the date of passage of this Act no person shall use or attempt to use in any of the transactions detailed in section 3 any weight or measure or weighing or measuring device designed, constructed, marked, or graduated in any other system than the metric system of weights and measures.

SEC. 5. That not later than ten years from the date of passage and approval of this Act all postage, excises, duties, and customs charged or collected by weights or measures by the Government of the United States shall be charged or

collected in or according to the metric system of weights and measures.

SEC. 6. That rules and regulations for the enforcement of this Act not inconsistent with the provisions hereof shall be made and promulgated by the Secretary of Commerce. The Secretary of Commerce shall also take such steps as he may deem expedient for giving publicity to the dates of transition specified herein and for facilitating the transition to the meter-liter-gram or metric system.

SEC. 7. That all Acts or parts of Acts inconsistent herewith are hereby repealed but only in so far as they are inconsistent herewith; otherwise they shall remain and continue in full force and effect. Whenever in any Act, or rules and regulations, or tariff or schedule made, ratified, approved, or revised by the Government of the United States of America weights or measures of the system now in customary use are employed or referred to, and to comply with the provisions of this Act weights and measures of the metric system should be employed, then such references in such Act, rules and regulations, tariff, or schedule, shall be understood and construed as references to equivalent weights or measures of the metric system ascertained in accordance with the required degree of accuracy.

SEC. 8. That nothing in this Act shall be understood or construed as applying to—

(1) Any contract made before the date at which the provisions of this Act take effect;

(2) The construction or use in the arts, manufacture, or industry of any specification or drawing, tool, machine, or other appliance or implement designed, constructed, or graduated in any desired system;

(3) Goods, wares, or merchandise intended for sale in any foreign country, but if such goods, wares or merchandise are eventually sold for domestic use or consumption then this clause shall not exempt them from the application of any of the provisions of this Act.

SEC. 9. That nothing herein shall be understood or construed as prohibiting the enactment or enforcement of weights and measures, laws or ordinances by the various States or cities, and the various States or cities shall have the same powers as though this Act were not in force and effect: *Provided, however*, That no standard weights or measures shall be established for the uses set out herein which conflict in any way with the standards established herein, and such standards which may already have been established shall be null and void for the uses set out herein.

SEC. 10. That the word "person" as used in this Act shall be construed to import both the plural and singular, as the case demands, and shall include corporations, companies, societies, and associations. When construing and enforcing the provisions of this Act the act, omission, or failure of any officer, agent, or other person acting for or employed by any corporation, company, society, or association, within the scope of his employment or office, shall in every case be also deemed to be the act, omission, or failure of such corporation, company, society, or association as well as that of the person.

Conditions Affecting the Selling of Machine Tools in Holland

BY JAN SPAANDER
President Spaander's Optische Slijperij, Lens Works, Amersfoort, Holland

To describe the present economic position of the engineering and allied industries in Holland would be an interesting study, but I will content myself with merely stating how things are going as the practical man sees them.

Things in the engineering line in Holland at present lay flat; and it is not so much a question of those who want to buy and can't and those who can buy and wont, as that so much has been bought during the last few years and so little sold to actual consumers. No further credit can be extended to dealers, the banks having overstepped the margin long ago, not being aware in time that the heavy exchange of machinery about one year ago was more a matter of speculation than the actual selling to manufacturers who were going to put the machinery to production work.

A little over a year ago I had to stock my machine shop and, having been used to American machine tools, I visited some dealers to buy what was wanted. They had plenty of American machinery in their showrooms, but they did not show the slightest interest in nor talk about these goods. When I insisted upon being told prices and all the ins and outs, one dealer candidly requested me not to waste our valuable time, as he was of the opinion that I was not crazy. After having seen the other machines "made in Germany" I was convinced that buying American machinery at that time would have been madness. The German machinery was not half as good, but the price was a fraction of that of the American tools.

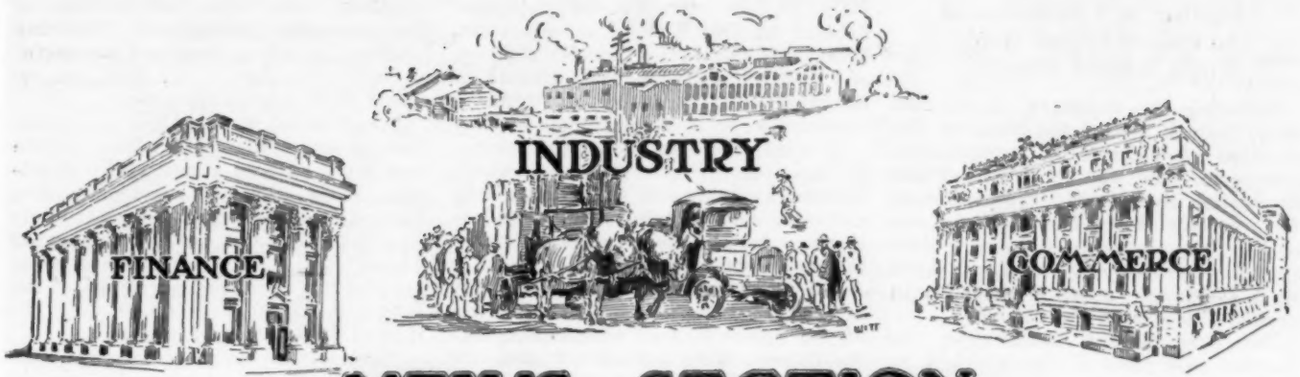
Even buying in a regular store would have been foolish, as Germans came pouring in by rail and even with little sailing vessels loaded to the brim with machine tools. One day I bought out of a little cellar in Amsterdam three heavy drilling machines at not quite $100, reckoning the dollar at 3.30 florins, about the exchange at that time. One Saturday night I was at a small watering place and there came a small German craft, a motor sloop, an old thing of the German navy. The captain, a man who had been shot through the foot, had no Dutch money and he sold me a first rate milling machine with a dividing head and a complete set of cutters for not over $300. No wonder that Holland was saturated with machinery in no time.

The German government, of course, was well aware that this kind of business was not to the advantage of Germany, and to put a stop to the "Verschleuderung," of materials, they did not give any further consent for export unless the home price was multiplied by some number, depending partly on the exchange of the country to which the material was being exported. This action put a considerable check on the importing of German machinery into Holland, but at the same time gave the Dutch machinery speculators a better opportunity to dispose of their wares.

The conditions still excluded sales of the more common American machines, but opened up a limited field for special heavy machinery, especially grinders, which will still have a chance, as the American stones are far superior, and the German stones that I have come across are of very poor quality. Heavy machines, of course, could not be articles for speculation, and were bought only when actually needed. As the American machines were far superior throughout and as the users of heavy machinery make quality a first consideration, the previous dumping of German goods has no effect in this case.

Besides the two reasons stated, that is "no credit" and "saturation," there is a third reason why manufacturers do not buy, and that is the entire lack of orders. Germany sells its raw materials at a tremendous price; and, in competition with German manufacturers, it happens time and again that the Dutchman cannot get the raw materials for which the German also delivers the finished articles. This pertains especially to large machined castings and structural work.

Besides the German competition, the English also are on the warpath and try to force sales by giving machinery in commission, because they know that sales often depend upon time of delivery.



NEWS SECTION

Huston Appointed to Assist Hoover in Department of Commerce

A business man has been selected to serve as chief lieutenant to Herbert Hoover in his capacity of Secretary of Commerce. The new Assistant Secretary of Commerce is Claudius H. Huston, of Chattanooga, Tenn. He is the president of the Tennessee River Navigation Co., the largest operator of steamboats on the Tennessee River. He is also the president of three wholesale jobbing houses and is connected actively in the management of a number of manufacturing enterprises. Mr. Huston is a director of three Chattanooga banks and is president of the Lee Highway Association, vice-president of the Dixie Highway Association and president of the Tennessee River Improvement Association. Mr. Hoover stated some weeks ago that the problem in finding an assistant secretary was to induce a $25,000 man to work for $5,000.

Mr. Huston was born on a farm in Harrison County, Indiana, on Feb. 15, 1876. He became a country schoolteacher at the age of sixteen and later worked his way through Valparaiso University. In 1898 he went to Chattanooga to teach in the Chattanooga Normal University. He gave up his business college work to undertake the management of the Chattanooga Machinery Co., which was later merged with another company and at present is one of the largest plants in the United States making heavy sawmill machinery.

Laminated Shim Co. Moves Into New Factory

The Laminated Shim Co. of New York, manufacturers of "Laminum" for shims, will remove on May 1 to its new plant and offices situated at 14th St. and Governor Place, Long Island City, N. Y. The popularity of laminated shims and the ever-growing demand for them is responsible for the development of the new plant. The building is of concrete and brick construction and the manufacturing space available totals 25,000 sq.ft.

Annual Meeting of the Machinery Club of Chicago

The annual meeting and election of the Machinery Club of Chicago was held on Tuesday, April 19, 1921. The day opened with a spirited election held to select the members of the Board of Governors, three chosen to guide the club's affairs for one year and four for a term of two years. After this election had been decided, the hold-over members met with the new members of the board and elected the officers who will guide the destinies of the club for the coming year.

J. R. PORTER
President of the Chicago Machinery Club

The complete roll of officers was announced at a dinner meeting and smoker held that same evening. They are: President, J. R. Porter, Marshall & Huschart Machinery Co.; vice-president, H. E. Procunier, Moon Manufacturing Co.; secretary, A. G. Bush, Minnesota Mining & Supply Co.; assistant secretary, H. F. Kempe, H. F. Kempe Co.; treasurer, H. J. Reeve, Dale Machinery Co. The new Board of Governors consists of the following members: J. R. Porter, H. E. Procunier, C. M. Robertson, D. R. Hoffman, E. L. Essley, S. A. Ellicson, H. F. Kempe, A. G. Bush, H. J. Reeve, C. J. Becker, A. W. Smith and H. S. White.

Following the dinner in the evening, at which in the neighborhood of two hundred members were in attendance, an entertaining program was provided in connection with the smoker.

Inspection Trips Arranged for A. S. M. E. Spring Meeting in Chicago

Industrial Chicago has many things to show the mechanical engineer and is going to throw them open to inspection by those attending the spring meeting of the American Society of Mechanical Engineers, May 23 to 26. The places which offer to entertain guests are scheduled for each day so that the individual may suit his taste by selection daily, without feeling that he is missing something he would like to see. The arrangement is as follows:

Tuesday — International Harvester Co., McCormick & Deering plants; Sears, Roebuck & Co., wall paper manufacture, handling and shipping merchandise; Mandel Brothers, package handling, coal and ash handling, connection to sub-street tunnel system; Western Electric Co., manufacturer of telephone apparatus and cable for the Bell telephone system.

Wednesday—Illinois Steel Co., South Works, South Chicago, plate mill, rail mill, bessemer converters and general steel mill equipment; Commonwealth Edison Co., modern turbine central station at Fisk St.; Pennsylvania Lines terminal, freight handling plant, in connection with which there may be visited the neighboring warehouse of Marshall Field & Co. and the U. S. Terminal Building; Crane Co., manufacture of valves and fittings in cast iron, malleable iron, steel and brass, the fabrication of pipe work.

Thursday—Chicago Mill and Lumber Co., 120-in. paper machine, manufacture of fiber, corrugated board and paper boxes; Clemetsen Co., manufacture of veneers and "Clemco" office desks; Pullman Co., Pullman cars, passenger coaches and freight cars; Underwriters Laboratories, testing of appliances and devices for fire prevention; Yellow Cab Manufacturing Co., where the ubiquitous cabs come from.

Friday—Milwaukee Railway and Light Co.'s Lakeside plant, trip by rail to Milwaukee; Joseph T. Ryerson & Sons Co., warehouse of about a million square feet devoted to machinery and steel products. Other features will be announced later.

Chamber of Commerce of the United States Holds Ninth Annual Meeting

Following the meetings of the National Council and of the National Association of Commercial Organization Secretaries and the American Trade Association Executives the reception of the president of the Chamber of Commerce of the United States was held on Young's Pier at Atlantic City, April 26, as the formal opening of the Ninth Annual Meeting of the Chamber.

The first general session of the chamber took place at eleven o'clock on Wednesday morning and was featured by the address of the president, Joseph H. Defrees. In his remarks Mr. Defrees stressed the importance of taxation, tariff and transportation problems and sounded the keynote of the meeting, "More Business Methods in Government—Less Government Management of Business." He also replied to the charge that the chamber was identified with a conspiracy to crush organized labor, with a complete and emphatic denial. He said that the organization stood for the open shop with equal opportunity for all. Among the other big problems touched upon were those of housing, immigration and education.

The second general session was held Wednesday evening. The speakers were Willis H. Booth, vice-president of the Guaranty Trust Co. of New York, who took up the problems of foreign financing; and A. C. Bedford, vice-president of the International Chamber of Commerce, who spoke on the service which the International Chamber can render to American business.

Thursday was devoted to the tariff and taxation problems. At the general session in the morning, R. G. Rhett, chairman of the committee on taxation of the National Chamber discussed the findings of the committee on the taxation problem and the Hon. Marion DeVries, Judge of the United States Customs Court of Appeals made a strong plea for basing customs levies on American valuations of imports. He was followed by Harvey J. Sconce of Illinois who stated the case of the farmers in able fashion.

The only speaker at the Thursday evening session was the Hon. Herbert Hoover, Secretary of Commerce. It was estimated that nearly all of the 3,000 delegates registered, with their wives, managed to get into the big hall to hear what Mr. Hoover had to say. He reviewed briefly the various economic problems facing us and gave it as his opinion that we had turned the corner and were on the uproad to better times. The work which his department might do to which he seemed to attach the greatest importance was that of collecting and distributing business information for the benefit of all. He suggested that to the slogan of the convention be added the clause "More and better government service to business."

On Friday morning the delegates listened to Dr. Barnes, on education, Edward N. Hurley, on public utilities, and Col. Galbraith on the purposes of the American Legion—of which he is commander.

As usual, the afternoons were devoted to meetings of the various sections, Wednesday being set aside for purely sectional matters while Thursday was spent in further consideration of taxation and tariff matters.

The meeting ended after the Friday afternoon session at which the reports of the committees on nominations and resolutions were submitted and the resolutions discussed and acted upon.

Gear Manufacturers Meet at Cincinnati

Cincinnati lived up to almost all of the advance notices given the members of American Gear Manufacturers' Association, which held its fifth annual meeting at the Hotel Sinton. The only thing in which it may be said to have fallen down was the weather, and it is probable that any of the other cities that might have been selected would have done the same. There is no serious criticism as it was.

The A. G. M. A. has grown in four years from an organization with nine member companies to one of nearly one hundred. The Cincinnati meeting was attended by some 200 members and guests.

The first day's sessions were given over to addresses by President Sinram, J. B. Doan, president of the American Tool Works, G. M. Bartlett of the Diamond Chain and Manufacturing Co., and to reports of various committees. These reports, with those presented on the second day, indicated that the association is progressing in the matters of uniform cost accounting and standardization.

The third and fourth day's sessions were devoted to business, the reports of committees and the presentation of papers.

Ladies Entertained

The entertainment program aided greatly in making the meeting a success. The ladies were taken on a shopping tour through the large department stores, were given a theater party, and were entertained by a symphony concert.

A feature of the entertainment which was partaken of by members, guests and ladies was a four-hour automobile tour of Cincinnati and environs, conducted by the Cincinnati members and their friends of the machine-tool industry. The trip included inspection of the plants of the Cincinnati Gear Co., the Tool Steel Gear and Pinion Co. and the Acme Machine Tool Co. Refreshments were served. The typewritten itinerary stated, "left Spring Grove Ave., passing the Acme Machine Tool Co." Those present will remember with pleasure that this detail was altered to include a brief stop-over and inspection of the Acme plant.

Among other enjoyable features of the program were the Thursday luncheon, at which Senator Cartwright, of California, gave a talk that was received with earnest applause.

The informal banquet held on Friday evening was a successful climax to the first three days of a noteworthy meeting. F. W. Sinram was toastmaster. Edward S. Jordan, president of the Jordan Motor Car Co., spoke on "Looking Ahead" and Charles Woodward, vice-president in charge of personnel of the Hydraulic Steel Co., spoke on "The Human Element in Business."

Many of the members attended the meeting of the Cincinnati section, American Society of Mechanical Engineers on Thursday evening. W. F. Zimmerman, chief engineer of the Gould & Eberhardt Co., gave an illustrated lecture on "Methods of Gear Manufacture," and Major Earle Buckingham of the Niles-Bement-Pond Co., spoke on "Maag Gears and Methods of Cutting."

Germans Cornering Latin-American Steel Markets

The report that the Krupps had been granted a concession by the government of Chile for the erection of an immense steel and munitions plant in that country caused no surprise here for the reports from all parts of South and Central America to the Department of Commerce indicate that the German commercial activity interrupted by the war is making itself felt with renewed vigor in Argentina, Brazil, Mexico and Chile and other countries to the south of the United States.

Competition for U. S.

It was alleged recently that Americans were financing Germans in Mexico, and the State Department was asked to investigate, but no official report has been made on it. Uruguay is also reported to have extended credit to Germany and Austria, and all signs point to the prospects of the United States having to work hard to keep the lead in business with the countries of South and Central America.

The proposed tariff legislation is being regarded with some apprehension by Latin-American countries, and the assertion is made by representatives here that if the United States makes it difficult for them to sell goods in this country it will be found that they will buy in other markets.

Specifically, one of the reasons for an emergency tariff has been the alleged necessity of preventing the dumping of agricultural products from South American countries in the United States, where there is already a surplus.

The effects of German agents in the field in the Latin-American countries are already evident, and it is alleged that they have been able to deliver goods before the trade representatives of other countries have learned that there was a demand for them.

Personnel Research Federation Is Organized

Under the auspices of the National Research Council and Engineering Foundation, in the building of the National Research Council, Washington, D. C., the organization of the Personnel Research Federation was effected March 15. The federation includes in its membership scientific, engineering, labor, management and educational bodies. It has been organized to bring about interchange of research information among the numerous organizations who are engaged in personnel research. It is reported to the new federation by the Bureau of Labor Statistics, of the Department of Labor, that there are 250 such organizations in the United States. The Personnel Research Federation will collect research information, will encourage research through individuals and organizations and will co-ordinate research activities.

Temporary officers were elected as follows: Chairman, Robert M. Yerkes, representing National Research Council; vice-chairman, Samuel Gompers, representing American Federation of Labor; treasurer, Robert W. Bruere, representing Bureau of Industrial Research; secretary, Alfred D. Flinn, representing Engineering Foundation; acting director, Beardsley Ruml, assistant to the president of Carnegie Corporation, of New York.

AIMS AND PURPOSES

The aims of the new organization are: Increased efficiency of all the personnel elements of industry—employer, manager, worker — and improved safety, health, comfort and relationships.

The immediate purposes of the Personnel Research Federation will be: To learn what organizations are studying one or more problems relating to personnel and the scope of their endeavors; to determine whether these endeavors can be harmonized, duplication minimized, neglected phases of the problems considered, and advanced work undertaken.

Commercial Possibilities of South Africa

The National Foreign Trade Council has just issued a survey, in booklet form, of the recent industrial expansion and the mineral and agricultural resources of South Africa—a market presenting great possibilities for American enterprise.

The subject matter covers an extensive field including manufacturing, mining, agriculture and stock raising. Statistics on all these enterprises are furnished. The text also includes a general survey of the population, climate, railways, principal cities and harbors.

Copies of this book may be obtained free of charge by request to O. K. Davis, secretary of the Foreign Trade Council, Hanover Square, New York City.

Weir Co. To Open Factory in Canada

G. and J. Weir (Canada), Ltd., has started the construction of a foundry at Ville la Salle, near Montreal, for the manufacture of Weir pumps of all kinds, including oil fuel pressure pumps, oil-fuel transfer pumps, service pumps (for ballast fresh water and general purposes), turbine-driven circulating pumps, dual air pumps, direct-acting feed pumps, turbo-feed pumps, and others.

For the past twenty-five years these pumps have been imported from Glasgow, but since 1918 the Canadian subsidiary of the Weir company has been importing the parts and assembling them in the works here. With the operation of the new foundry, which is expected to be ready for work in a couple of months, the whole process of manufacture can be carried out in the vicinity of Montreal, and will offer special facilities for ships arriving in the port of Montreal and requiring repairs or replacement of any parts.

It is purposed to start with a staff of some fifty molders and the necessary complement of other workers, but with the steady development of the port of Montreal it is anticipated that the industry will rapidly grow.

Machinists' Union To Act for Mexican Government

The International Association of Machinists, with headquarters at Washington, D. C., under an agreement just reached, has been named commercial representative of the Mexican government in this country. The machinists' organization will act as official advisers to the Mexican government which binds itself to use products of "union shops" only in the establishment under its control.

An active movement now exists in Mexico, according to E. C. Davidson, secretary of the machinists, for farm machinery and standard railroad equipment. The policy of his office under the agreement, he said, would be to assist manufacturers of those products who have been fair to organized labor in placing orders with the Southern republic.

It is understood the Mount Vernon Savings Bank, which is controlled by the machinists' association, will be utilized for necessary financing operations.

Negotiations looking to a similar appointment of the association by the present Russian government is understood to have been started. Officials of the machinists are now awaiting a reply to definite proposals they have made to Russia.

Who Knows?

One of our readers wants to know who is the manufacturer of the Herman internal combustion engine. It was intended for use in a one-man motor car. We will be glad to have any information bearing on the subject.

Plenty of Tungsten Ore in the United States

Tungsten stocks in the United States probably are sufficient for the requirements of this country for more than three years. This is the opinion of Frank L. Hess, tungsten specialist for the U. S. Geological Survey. His further comments on the tungsten situation are as follows:

"Tungsten is used mostly for making high-speed tools for cutting steel, so that the demand for tungsten ore rises and falls with the steel business. In 1920, the steel business was very dull and the demand for tungsten was correspondingly small. At the same time in spite of the small demand, the imports were rather large for peace times and consisted in part of very cheap ore from the shallow placers of China. A good deal of the ore was apparently shipped to this country with the expectation that a heavy duty would be imposed on it and that ores in stock would accordingly increase in value. The imports for 1920 were 1,740 long tons of ore, probably averaging 65 per cent or more tungsten trioxide (WO_3) and were equivalent to about 2,111 short tons of concentrates carrying 60 per cent WO_3. Of this quantity, 1,386 short tons of 60 per cent concentrates were shipped from China and most of the remainder came from South America. Besides the ore, 1,997,719 lb. of tungsten and ferrotungsten were imported, equivalent to about 2,250 short tons of 60 per cent ore, and probably more than enough to supply the needs of the high-speed tool industry, so that there was added to the already large stocks in this country somewhat more than the quantity of tungsten represented by the imports of ore."

Educational Bulletin Issued by Chamber of Commerce

What a "Cost System" Should Do for You, is the subject of a small pamphlet issued by the Fabricated Production Department, Chamber of Commerce of the United States.

The Fabricated Production Department is one of several service departments recently created by the Chamber to assist its members in dealing with their common problems, especially those concerned in manufacturing and production. These include such subjects as Cost Accounting, Standards, Elimination of Excess Variety, Production Statistics and Industrial Relations, etc.

Its service will be largely educational and co-operative in character, bringing together those interested in a given problem, and by the interchange of experiences and expert advice, reaching a satisfactory conclusion whenever possible.

These pamphlets will be issued only after careful preparation and will deal with the broad fundamentals of business efficiency and service. It is hoped to keep them practical and to the point.

Business Conditions as the Big Banks of the Country See Them

Guaranty Trust Co. Sees Renewal of Business Activity—Readjustment Slow—Wages Must Come Down

The abrogation by the Railroad Labor Board of the national agreements defining working conditions in the railroad shop crafts is a well-directed contribution toward the solution of the urgent railway problem. The abrogation of the agreements is to become effective July 1. The rules and regulations embodied in these agreements have in many ways unduly restricted the freedom of railway managers and unjustifiably increased operating costs. It is desirable that the handicaps imposed upon the railways by those war-time regulations which no longer serve a useful purpose should be removed as speedily as possible. The ruling of the board in favor of separate negotiation between individual roads and their employees was accompanied by the announcement of a set of sixteen principles for the guidance of both parties in their negotiations. These principles would fully safeguard labor's rights in the matter of working conditions.

Events seem to be leading to other significant developments in the field of transportation. Both wages and rates may be revised without much delay. More than one-half of the 200 railroads reporting to the Interstate Commerce Commission failed to earn expenses and taxes in each of the first two months of the current year. The necessity for an improvement in the relation of earnings to expenses is urgent. A further general raising of rates is not to be considered. The remedy for the existing situation must, it seems, include reductions in wages, which constitute the major part of railway operating costs.

Recession in Steel Prices

Reductions in prices of a number of iron and steel products, ranging from $1.50 to $15 a ton, announced by the United States Steel Corporation on April 12 and later, represent a step of fundamental importance in the continued industrial readjustment.

The full effect of these price reductions on the volume of new contracts may not be known for several weeks. It is significant, however, that the International Harvester Co., basing its action upon the revision of steel prices, promptly announced a reduction of 10 per cent in the prices of its products in which steel is the principal element, the new prices to become effective in 1921.

Shortly before the steel corporation's reduction of prices was announced, however, a number of prices were raised by independent producers. The degree of uniformity in prices throughout the trade which has been introduced by these revisions may measurably stimulate confidence that the present prices will continue for a comparatively long period, with a consequent increase in orders for steel and iron products.

Instance of Renewed Activity

Increased production has followed the reviving demand for passenger automobiles and trucks. As was to be expected, the renewed demand was first for the lower priced cars, but now the producers of higher priced automobiles also are finding a growing demand. One large producer reported early in the month that the sales of its cars for delivery in April, May, and June were far in excess of sales for the corresponding period of any other year in the company's history. While this favorable showing is not typical of the industry as a whole, other makers are expanding their production and sales. In Detroit and other automobile manufacturing centers plants that were closed have recently resumed operation and others have increased the scale of activities, some to full time operation. This has materially reduced the number of the unemployed in those centers.

Readjustment Is Incomplete

The low points already reached by many prices and the increased activity noted have resulted in a growing confidence in business circles that some branches of industry are now experiencing what will prove to be the beginnings of a general revival of activity.

Until the liquidation of inventories and the readjustment of individual prices has gone further, an adequate basis will be lacking for the confidence which must serve as the foundation for normally active business.

Revision of Wages Essential

Any broad readjustment of commodity prices necessarily involves changes in wages also. There are exceptions, of course, and the readjustments in directly related prices and wages are frequently not simultaneous. As in the case of prices, some wage scales now remain at the high levels reached in the boom period. On the whole, however, wages are being reduced, without extreme opposition on the part of the workers.

The necessity for initial or further wage reductions is quite generally recognized. Wage agreements, some covering protracted periods, have obstructed the inevitable readjustment in transportation, mining, building, and other industries.

The lagging of living costs in relation to wholesale prices in the downward revision adds to the continuing complexity of the industrial problem as a whole. Many retail prices have only very tardily reflected the decline in wholesale prices. Nevertheless, it is apparent that significant wage reductions must precede the establishment of any durable equilibrium in industry.

Export Trade With Mexico Doubled in Last Year—Imports Also Increased

The purchasing power of our neighbor across the Rio Grande—Mexico—shows a less decline than that which characterizes conditions in many other countries. Our exports to Mexico in the fiscal year which ends with next month will, according to a statement by the National City Bank of New York, be double those of the preceding year and six times as much as the annual average prior to 1918 when her great oil outturn multiplied her purchasing power.

Exports from the United States to Mexico, continues the bank's statement, which averaged less than $50,000,000 a year prior to 1917, suddenly jumped to $107,000,000 in the fiscal year 1918, $120,000,000 in 1919, $144,000,000 in 1920, and will be approximately $280,000,000 in 1921. This tremendous growth in our exports to Mexico in the very recent period and especially the current fiscal year has continued down to the latest moment despite the fact that exports to nearly all other parts of the world show for the latest month a decline. Total exports to Mexico in the single month of February, 1921, the latest for which figures are now available, were $25,000,000 against $12,000,000 in the same month of the preceding year and for the eight months ending with February, 1921, $187,000,000 against $87,000,000 in the same months of the preceding year. In fact, no other country shows this unique record of having more than doubled its takings of United States merchandise in the fiscal year 1921.

On the import side, the growth has also been large, though not so great proportionately as in exports. The total imports from Mexico, which prior to the oil period averaged about $75,000,000 a year, were $112,000,000 in the fiscal year 1917, $158,000,000 in 1919, and will be about $170,000,000 in 1921. Thus our imports from Mexico in 1921 will be approximately three and one-half times as much as the "pre-oil" average, and the exports to that country nearly six times as much as that of the period in which the plentiful petroleum supplies gave to Mexico a high purchasing power.

Washington Notes

By Paul Wooton
Washington Correspondent

Authority has been given for the transfer of the ordnance school of application from the proving grounds at Aberdeen, Md., to Massachusetts Institute of Technology. All of the equipment at the Aberdeen school is being moved to Boston. The school now is to be known as the Ordnance School of Technology and will handle all of the theoretical side of the training of ordnance officers. The shop practice portion of the training will be continued at Watertown Arsenal. The commanding officer at Watertown will have immediate jurisdiction over the school, although the instruction will be entirely in the hands of the teaching staff of the institute. The course is to include advanced mechanics, applied mechanics and the various types of engineering which must be applied to ordnance. After the course at Boston Tech the officers must take the prescribed courses in shop practice at Watertown. This constitutes the basic course. Specialized training then is begun.

The technical staff of the Bureau of Ordnance of the War Department has extended an invitation to the American Society of Automotive Engineers to visit the Aberdeen proving ground. It is hoped that the association will make this side trip one of the features of its meeting this fall.

One of the lessons which the war taught to ordnance officials was the inadvisability of making public the results of ordnance development. An effort now is being made to adopt a policy which will prevent the results of ordnance research and development from falling into the hands of other governments and at the same time will enable technical men of unquestioned loyalty, who may be relied upon to keep a secret, to be acquainted with the intimate details of the work. This gives the government the advantage of their thought in connection with these problems and it is believed that any undesirable circulation of the information can be prevented. Special lectures are to be given before the new ordnance section of the American Society of Mechanical Engineers. Membership in this section is to be limited to Americans who are known to be persons of discretion.

One of these executive sessions of the ordnance section of the American Society of Mechanical Engineers is to be held at the Rock Island Arsenal May 27.

Commerce Appropriations

Machine tools and other heavy machinery are items slated by the Secretary of Commerce to receive governmental assistance in the matter of extension of their export market. Secretary Hoover has asked Congress for supplemental appropriation aggregating $618,728.34. Of that amount Mr. Hoover would like to allot $250,000 to assist in promoting the foreign trade of certain of the export industries. His plan is to establish twelve divisions in the Bureau of Foreign and Domestic Commerce, each of which would work on the problems confronting one of the following industries: machine tools and heavy machinery, cotton and cotton goods, paper and paper products, leather and leather products, chemicals (including dyestuffs), electrical goods of all kinds, automobiles and accessories, lumber and lumber products, metal products, vegetable oils, hardware, jewelry and silverware. Two experts are to be assigned to each of the industries, whose time is to be divided between field investigations and service in the bureau at Washington.

Investigations looking to the prevention of industrial waste also are proposed by Mr. Hoover. He has asked Congress to allow an expenditure of $100,000 for that purpose. The work will be assigned to the Bureau of Standards.

Secretary Hoover also asks for $100,000 to be used in the standardization of equipment. His plan is to have the Bureau of Standards co-operate with manufacturers, engineers, government departments and the public in establishing manufacturing and commercial standards of machinery and equipment with the idea of eliminating unnecessary forms, varieties and qualities. He declares that such standardization is of the utmost importance in the economical construction and use of equipment and one of the dominant factors involved in both foreign and domestic trade. Mr. Hoover believes that his department is in a position to co-operate with both manufacturers and users in bringing about voluntary acquiescense in the use of standards of this kind.

N. Y. Postal Problems

Reorganization of the motor truck fleet of the New York post office so as to employ electric, rather than gas driven trucks, will result in a large saving of money and will increase the efficiency of the service, according to a report made by W. B. Richards & Co. to the Federal commission which is examining the mail facilities in New York City. Richards & Co. was employed by the commission to report on the engineering phases of New York's postal problems.

A. S. M. E. at Atlanta

A joint meeting of the Birmingham, New Orleans, Mobile and Atlanta sections of the American Society of Mechanical Engineers was held Friday, April 22, at Mobile, Ala. Several members of the council of the national society attended the meeting. While in Mobile a tour of inspection was made by the visiting engineers through the plant of the Chickasaw Shipbuilding and Car Co.

Business Items

Gowdey & Craig, Inc., of Providence, R. I., has recently been incorporated with a capital stock of $35,000 to deal in machinery, etc. The incorporators of the new concern are: William B. Gowdey, Edward G. Lyon and H. G. Commangton, all of Providence.

Announcement has been made that the Traction Foundry and Machine Co., organized under the laws of Michigan, will establish a branch at Laporte, Ind. H. E. Strawbridge, of Laporte, has been named as the company's representative in that state. A total of $50,000 of the capital stock of the company is represented in Indiana.

The Barrett Coal Co., 349 West McCarty St., Indianapolis, Ind., will begin work shortly on the construction of a machine shop to be used for general repairs for the equipment of the company. The building will be one story high, 32 ft. wide and 90 ft. long, of brick construction.

The Wheel Trueing Tool Co., importers of industrial diamonds and manufacturers of diamond pointed tools, with general offices in Detroit, Michigan, announces the removal of its Western office from the Wells Bldg., Milwaukee, Wis., to its branch office in the Great Northern Bldg., 20 Jackson Boulevard West, Chicago, Ill.

William J. Sansom will be in charge at the new location. The change was effected April 1. Mr. Sansom has been representing the Western office for the past three years. He was formerly night superintendent of the Milwaukee works of the International Harvester Corporation and prior to that instructor of mechanical practice, University of Wisconsin.

The Austin Machinery Corporation, Chicago, Ill., announces that it will rebuild its plant which was recently destroyed by fire. This company also has factories at Muskegon and Toledo, and only recently consolidated with the Fairmont Mining Machinery Co., at Fairmont, W. Va.

Papers have been filed in Massachusetts for the incorporation of the Clark-Hunter Co., of Boston, Mass., with a capital stock of $100,000. The company will manufacture machinery and motors. The incorporators are Thomas Clark, Foster J. Finley, Robert H. Hunter and A. P. Norris.

The Atlas Crucible Steel Co., with plants at Dunkirk, N. Y., and Welland, Ont., Canada, has moved its general offices, including general sales, to the Hanna Building, Cleveland, Ohio. The company has recently extended its facilities and in addition to its regular production of tool steels, is now in a position to furnish alloy steels. Frank P. Case will be in charge of the sale of tool steels and Harry J. West will be in charge of the sale of alloy steels.

D. J. Renaud & Son, Inc., has been recently organized to do general manufacturing business including foundry and machine shop work.

Hickok & Hickok opened offices on April 1 in the Title Insurance Building, Los Angeles, Cal., with Horace J. Barton as manager, representing the United Steel Alloy Co. of Canton, Ohio; the Pollak Steel Co.; Keystone Bronze Co.; Edgewater Steel Co.; Stroh Steel Hardening Process Co.; Fort Pitt Spring and Manufacturing Co. and the Iron City Products Co.

The Monon shops at Lafayette, Ind., re-opened April 1, taking back between 500 and 600 men who were laid off recently. The same force of workmen, representing all crafts, will be employed as before the close of the shops, officials announced.

The Black & Decker Manufacturing Co. will be represented in the South by Thomas W. Peters who has for the past fifteen years been located in Columbus, Ga., where he has occupied responsible positions in executive and engineering capacities. The southern territory includes all the southern states east of the Mississippi River and, in the very near future, a regular branch office will be established at Atlanta, Ga., where Mr. Peters will make his headquarters.

The Bellis Heat Treating Co. of New Haven, Conn., has recently been organized to deal in machinery, tools, heat-treating fixtures, etc. The company is incorporated with a capital stock of $75,000, and the incorporators are Howard E. Adt, Harrison Hewitt and W. B. Gumbert, all of New Haven, Conn.

The Waldron Tool and Metal Manufacturing Co. of Norwich, Conn., has recently added $150,000 to its capital stock.

The International Metal Specialty and Manufacturing Co. of Bridgeport, Conn., has recently been organized and incorporated with a capital stock of $25,000. The company will manufacture metal specialties, etc. The organizers are Martin Karmark, of Milford, Conn., and G. O. Gabriel, of Bridgeport, Conn.

The Frey Variable Speed Gear Co., of Holyoke, Mass., has been recently organized and incorporated with a capital stock of $50,000, to manufacture gears, etc. The officers of the new company are Ellsworth Frey, president; Charles H. House, treasurer. Mr. Frey and Mr. House, together with F. H. Gross, form the board of directors of the company. All are from Holyoke, Mass.

Perrigo, Inc., of New Haven, Conn., has recently been organized and incorporated in the State of Connecticut, with a capital stock of $250,000, to engage in and carry on a general manufacturing and jobbing business. The incorporators are Harry B. Perrigo, W. L. Harlow, E. C. Burwell, S. T. Haskell, W. M. Grant and N. E. Davidson, all of New Haven, Conn.

At a meeting of the directors of the Victor Saw Works, Springfield, Mass., the resignations of Frank M. Baldwin and William P. Jeffery, as president and vice-president respectively, were tendered and accepted. William F. Pollock was elected president, and Guy W. Donahue, vice-president. The board of directors was increased to five members.

The W. T. Dunn Co., 10 High St., Boston, Mass., has been appointed New England sales agent for B. M. Jones & Co., Inc., 192 Chambers St., New York, importers of Mushet and Titanic tool steels and Taylor's best Yorkshire iron. W. T. Dunn, a member of the firm, was for a number of years general manager of the International High-Speed Steel Co. of Rockaway, N. J.

Personals

RUSSELL B. REID, for several years past with Edw. R. Ladew Co. as assistant sales manager, has been made manager of sales for the Sharon Pressed Steel Co., of Sharon, Pa., manufacturer of motor car frames, industrial trucks and pressed steel automobile parts. Mr. Reid will direct the sales of the company from the New York office at No. 66 Broadway.

CLYDE E. DICKEY has resigned as general manager of the Hammond Steel Co., Inc., Syracuse, N. Y., effective May 1, 1921. Mr. Dickey is president of the Dickey Steel Co., Inc., 233 Broadway, New York City, and will devote all of his time to this company in the future.

F. C. HERMANN, for some years associated in the Chicago territory with the Stocker-Rumely, Wachs Co., and who has lately been associated with the Reed-Prentice Machine Tool Co. and the Becker Milling Machine Co., has joined the selling organization of the Dale Machinery Co., Chicago. In his new connection Mr. Hermann will handle the sales of the two machine-tool companies which the Dale Machinery Co. has taken over in the Chicago territory since the recent Prentice and Becker companies discontinued their Chicago store.

LESLEY POWELL, for several years sales manager of the Rowe Calk and Chain Co., Southington, Conn., has resigned to accept a similar position with the Tropical Paint Co., Columbus, Ohio.

JOHN B. PURVES is now with the Port Arthur Shipbuilding Co., Ltd., Port Arthur, Ontario, Canada. He was formerly mill manager for the Interlake Pulp and Paper Co., Appleton, Wis.

H. B. MACFARLAND has resigned his position as engineer of tests for the Atchison, Topeka & Santa Fe Ry. Co., and is now engaged in work as consulting engineer, Chicago, Ill.

GORDON LEFEBVRE, associated with the Chevrolet Motor Co., has been transferred from Tarrytown, N. Y., to Detroit, Mich.

CHARLES R. SEABROOK, recently member of the firm and chief engineer of the H. M. Lane Co., Detroit, Mich., is now associated with E. H. Owen, formerly superintendent of construction and chief draftsman of the H. M. Lane Co., under the firm name of Owen & Seabrook, industrial engineers, with offices in Detroit, Mich.

JAMES W. ARMOUR has recently been transferred from the Murphy Iron Works plant in Detroit, to the factory of the Sanford Riley Stoker Co., Ltd., at Worcester, Mass. The Murphy Iron Works is a subsidiary of the Sanford Riley Stoker Co.

BERNARD E. MOHR has resigned as manager of the machine-tool department of the Fairbanks Co., St. Louis, Mo., and has opened up offices at 5407 Easton Ave., where he will deal in new and used machine shop equipment.

H. W. TORNEY, head of Torney & Co., of New York, has been elected president of the Sharon Pressed Steel Co., Sharon, Pa., succeeding J. D. Cochran.

Forthcoming Meetings

The seventh annual convention of the American Association of Engineers will be held at Buffalo, N. Y., on May 9, 10 and 11, with headquarters at the Lafayette Hotel.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The spring meeting of the National Association of Manufacturers will be held in New York, May 16, 17 and 18 at the Waldorf-Astoria Hotel. The headquarters of the association is at 30 Church St., New York City.

The Taylor Society will hold its Spring Meeting at the Hotel Statler, Cleveland, Ohio, May 19 to 21

The spring meeting of the American Society of Mechanical Engineers will be held at the Congress Hotel, Chicago, May 23-26. Calvin W. Rice, Engineering Societies Bldg., 29 West 39th St., New York, is secretary.

The Society of Automotive Engineers, 29 West 39th St., New York announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

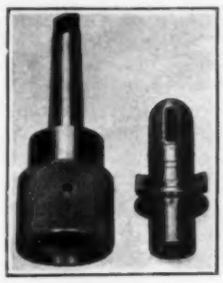
The American Railway Master Mechanics Association will hold its Spring Meeting at the Drake Hotel, Chicago, Ill., on June 15 and 16.

The 1921 annual meeting of the American Society for Testing Materials will be held at Asbury Park, N. J., on June 20 to 24, with headquarters at the New Monterey Hotel. C. L. Warwick, Engineers Club, Philadelphia, Pa., is secretary.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Chuck, Drill, Slip-Collet, Quick-Action
Dompier Chuck Co., 446 Book Bldg., Detroit, Mich.
"American Machinist," Feb. 17, 1921



The chuck is intended for use in drilling, boring and reaming. The illustration shows the collet out of the chuck, the removal being accomplished by raising the collar. The collet can be inserted without lifting the collar, thus requiring the use of only one hand. The chuck and collet are made of hardened and ground steel, the wearing parts being chrome-nickel steel. The grip is positive and instantaneous. The device is capable of operation at any speed or in any position. The chuck is made in four sizes, having from Nos. 2 to 5 Morse taper shanks. The collet is made in sizes to fit the different chuck sizes, and to take from Nos. 1 to 5 Morse tapers.

Saw, Coping, Adjustable, No. 30
Consolidated Tool Works, Inc., 261 Broadway, New York, N. Y.
"American Machinist," Feb. 17, 1921

This is a type of coping saw in which the position of the blade can be easily adjusted by means of the pins at both ends of the blade, so as to cut in any desired direction, without shifting the position of the hands. The blade is tightened by turning the handle and may be locked at any angle. The frame is made of flat stock and is nickel plated and polished. The wooden handle is finished in black enamel.

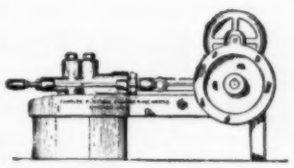
Gage, Plug, Tolerance, Replacable-End
C. E. Johansson, Inc., Poughkeepsie, N. Y.
"American Machinist," Feb. 17, 1921

The company formerly made tolerance plug gages below ¾ in. in diameter in one piece. By making the gage with replacable ends it is possible to save the unworn member (No-Go member) and the handle, and simply replace the worn member. The useful life of the gage is said to be extended indefinitely. The measuring members are securely locked in position by locking nuts, so that the ends will not unscrew when in use. The gage is made in sizes from ¼ to 47/64 in. in diameter, inclusive.

Bolt Combination T- and Extension "Ashmac"
Ashley Machine Works, 714 University Ave., Rochester, N. Y.
"American Machinist," Feb. 17, 1921

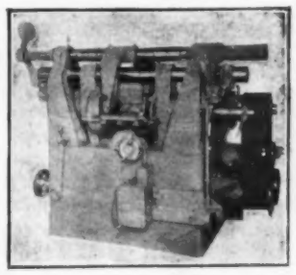
The bolt is intended for use in the T-slots of machine tools. It consists of a short T-bolt and a stud which can be connected to it by means of a nut, so as to give the necessary length. The bolt is fully machined, and is made of heat-treated and hardened alloy steel. The T-bolts and connecting nuts can be used with extension studs of different lengths, so as to provide T-bolts of whatever length desired for clamping work on a platen. The sets are ordinarily made in ⅝ in. size, the T-bolts being made in lengths of 2 to 4 in. in ½-in. steps, and the studs in even inch lengths, from 2 to 10 in.

Pump, Hydraulic, High- and Low-Pressure
Charles F. Elmes Engineering Works, Morgan and Fulton Sts., Chicago, Ill.
"American Machinist," Feb. 17, 1921



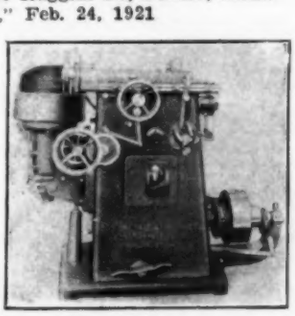
The pump is adapted for use with hydraulic presses. It will give a pressure up to 5,000 lb. per square inch by means of the high-pressure plunger, and up to 250 lb. per square inch by the use of the low-pressure plunger. A ¼-hp. motor will operate it at a speed of 100 r.p.m. The pump is arranged to automatically shift from the low pressure to the high pressure when the limit of the low-pressure cylinder has been reached. It is provided with a 1½-gal. tank for oil or water, and has a motor direct-connected and mounted on the frame at the right.

Grinding Machine, Form, No. 40
Bryant Chucking Grinder Co., Springfield, Vt.
"American Machinist," Feb. 24, 1921



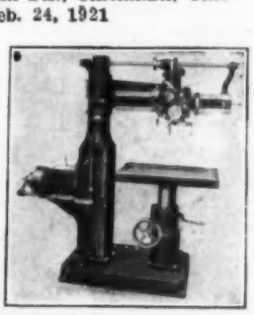
The machine is intended for the grinding in large quantities of pieces up to 10 in. long and having diameters up to 12 in. The wheel is fed straight toward the work, either with no traverse movement or with a traverse of only ¼ in. Pieces circular in section, but tapered or having different diameters on them, can be ground with but one contact with the wheel. This is accomplished by dressing the profile of the wheel to correspond to that required on the work, the master form being so mounted as to guide the diamond while dressing. The wheel is mounted on the bed. The work is held in centers so pivoted that they can be fed toward the wheel. The machine is semi-automatic in its operation, the work automatically feeding in and withdrawing.

Grinding Machine, Surface, 12-In. Rotary-Table
Boston Scale and Machine Co., 100 Ruggles St., Boston, Mass.
"American Machinist," Feb. 24, 1921



The tool is adapted to production work. The reciprocating motion of the head which carries the grinding-wheel spindle is obtained by the use of oil flowing under pressure, the direction of flow being controlled by a balanced reversing mechanism. A wide range of speed is provided for the reciprocating head. Change gears providing four rotative speeds for the chuck run in oil in a box which can be readily removed. The machine is arranged to carry a 12x1½-in. wheel, and it is furnished with a 12-in. circular magnetic chuck. It will grind the whole of a 13-in. disk. The sliding head can be set back, so as to grind a 6½-in. face on any disk up to 16 in. in diameter. A diameter of 17 in. can be swung inside the water pan. The machine weighs 2,800 lb. and takes up a floor space of 6x3 ft.

Drilling Machine, Radial, Sensitive, 2½-Ft.
The Crescent Tool Co., Second and Elm Sts., Cincinnati, Ohio
"American Machinist," Feb. 24, 1921



The machine, intended for high speed, heavy-duty work, is entirely gear driven and can be furnished in two styles, one being equipped with hand feed only. The other, in addition to the hand feed, has two changes of power feed and also a quick return motion. Specifications: Drills to center of 60-in. circle. Maximum distance end of spindle to base, 42 in. Maximum distance end of spindle to table, 20 in. Vertical traverse of spindle, 6½ in. Drilling capacity, 1¼ in. in diameter in steel. Size of table, 18x30 in. Vertical adjustment of table, 18 in. Size of base, 24x38x4 in. Spindle speeds, 132 to 1,100 r.p.m. Spindle feeds, 0.0055 and 0.017 in. per revolution. Floor space, 26x72 in. Approximate weight: net, 1,200 lb.; crated, 1,300 lb.; boxed for export, 1,400 lb.

Clip, paste on 3 x 5-in. cards and file as desired

THE WEEKLY PRICE GUIDE

This Week's Market

The metal market is quiet. Copper remains unchanged, but tin and lead have strengthened slightly. A new basing card on wrought pipe has been issued and we will publish the new discounts (four points cheaper) next week. Rivets are down in Pittsburgh, Cleveland and New York. Semi-finished materials are down slightly in Cleveland in keeping with lowered basic material costs and small demand.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$29.50
Northern Basic	27.52
Southern Ohio No. 2	28.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	35.26
BIRMINGHAM	
No. 2 Foundry	25.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75 sil	26.25@28.50
Virginia No. 2	*28.00
Basic	†26.25
Grey Forge	*27.00
CHICAGO	
No. 2 Foundry local	26.00
No. 2 Foundry, Southern, sil 2.25@2.75	32.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26.96
Basic	26.86
Bessemer	27.00

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	3.85	4.13
No. 12	3.15	4.30	3.90	4.18
No. 14	3.20	4.35	3.95	4.23
No. 16	3.30	4.45	4.05	4.33
Black				
Nos. 17 and 21	3.75	4.95	4.60	5.20
Nos. 22 and 24	3.85	5.00	4.65	5.25
No. 25 and 26	3.90	5.05	4.70	5.30
No. 28	4.00	5.15	4.80	5.40
Galvanized				
No. 10 and 11	4.00	5.30	4.70	5.70
No. 12 to 14	4.10	5.40	4.80	5.80
Nos. 17 and 21	4.40	5.70	5.10	6.10
Nos. 22 and 24	4.55	5.85	5.25	6.25
No. 26	4.70	6.00	5.40	6.30
No. 28	5.00	6.25	5.70	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	65%
Cleveland	50%
Chicago	50%

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	41
Electrolytic	43

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 1/16, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.20
Hoop steel	4.28	3.69	3.83
Cold rolled strip steel	6.00	8.25	7.90
Floor plates	5.30	3.09@3.40	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
¼ to 3	57½%	44%	⅛	15½–16½%	+10½–11½%
			¼	19½–20½%	1½– 2½%
			⅜ to 1¼	24½–25½%	8½– 9½%

LAP WELD

2	50½%	38%	2	20½–21%	6½– 7%
2½ to 6	53½%	41%	2½ to 6	22½–23%	9½–10%
7 to 12	50½%	37%	7 to 12	19½–20%	6½– 7%
13 to 14	41%				
15	38½%				

BUTT WELD, EXTRA STRONG PLAIN ENDS

¼ to 1¼	55½%	43%	⅜ to 1¼	24½–25½%	9½–10½%
2 to 3	56½%	44%			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	48½%	37%	2	21½–22½%	8½– 9%
2½ to 4	51½%	40%	2½ to 4	23½–24%	11½–12%
4½ to 6	50½%	39%	4½ to 6	22½–23%	10½–11%
7 to 8	46½%	33%	7 to 8	14½–15%	2½– 3%
9 to 12	41½%	28%	9 to 12	9½–10%	+2 –2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 2½ in. steel butt welded	52%	37%	52½%	33½%	62½%	44%
3½ to 6 in. steel lap welded	49%	35%	49½%	29½%	58½%	41%

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13.62½
Tin in 5-ton lots	32.50
Lead	4.87½
Zinc	5.60
ST. LOUIS	
Lead	4.47½
Zinc	5.20

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.00	22.00	23.50
Copper wire (carload lots)	15.00	17.50	20.00
Brass sheets	17.25	24.00	24.50
Brass pipe	21.00	22.00	20.75
Solder (half and half) (case lots)	18.00	20.50	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	15.25
Cleveland	19.00
Chicago	18.75

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill + less 8% for carload lots..... 11.50

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	13.70	14.30
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.25
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$9.75
Copper, heavy, and wire	9.00	9.50	8.50
Copper, light, and bottoms	8.00	9.00	8.00
Lead, heavy	3.25	3.50	3.50
Lead, tea	2.00	2.50	3.00
Brass, heavy	6.00	7.00	9.00
Brass, light	4.50	4.50	4.50
No. 1 yellow brass turnings	5.00	5.50	5.00
Zinc	3.00	3.00	3.00

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.50@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.00
Chicago	20.50
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	42.00	35.00
Commercial	30.00	15.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$2.00	1.60
Hot pressed hexagon	List	2.00	1.60
Cold punches hexagon	List	2.00	1.60
Cold punched square	List	2.00	1.60

Semi-finished nuts, ⅜ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	75–10%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50–10%	60–10%	50%
1¼ and 1½ in. by 3 in. up to 12 in	50%	50–5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland ..... $4.00 Chicago..... $4.00
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	40%	50–10%	40%
Larger and longer up to 1 in. by 30 in.	40%	50%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	50%	60%	45%
Tinned	45%	60%	30%

Structural, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.65 Cleveland...$4.60 Chicago....$4.88 Pittsburgh..$3.70
Boiler, same sizes:
New York...$4.75 Cleveland...$4.70 Chicago....$4.98 Pittsburgh..$3.80

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	21.00	24.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ⅛-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$8.50 per 100 lb.; New York price is 8c.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	10.00@13.00	12.50	14.25
Colored mixed	7.00@11.50	9.50	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$3.50@$4.25
Prompt foundry	4.50@ 5.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.67	$0.66	$0.68
5-gal. cans	.70*	0.81	0.93

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

NEW *and* ENLARGED

Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

D. C., Washington—The D. C. Comrs. Dist. Bldg., will receive bids until May 12 for furnishing machine shop equipment for use in surface division.

D. C., Washington — A. L. Flint, Genl. Purch. Agt. of the Panama Canal will receive bids May 11 for furnishing miscellaneous hand tools.

Md., Baltimore—D. C. Elphinstone, 408 Continental Bldg.—15 in. swing turret lathes, 6 ft. to 8 ft. long, also 20 or 25 ton locomotive crane.

Md., Baltimore—The Engineering and Sales Serv. Corp., 810 Lexington Bldg., H. L. Clapham, Pres. (agents for Alabama Mica & Mfg. Co.)—machinery for wet process mica grinding, and machines and tools for cutting discs on washers.

N. Y., Buffalo—The Eberhart Steel Products Co., 825 East Ferry St., W. C. Robbins, Mgr.—lathes and other machinery for the manufacture of steel products.

N. Y., Ellis Island—(New York P. O.) The Dept. of Labor, Bureau of Immigration—precision bench lathe, 14 in. lathe, Universal cutter and tool grinder, sensitive drill, portable electric drill and other miscellaneous machine tools.

N. Y., Lincoln Park—The Kneeland Mfg. Co., manufacturers of paper making machinery, L. W. Kneeland, Purch. Agt.—welding machine.

N. Y., Long Island City—The Harolds Motor Corp., Jackson Ave.—1 turret lathe.

N. Y., New York—(Borough of Manhattan) The Imperial Japanese Navy, 1 Madison Ave.—1 Universal grinding machine.

N. Y., New York—(Borough of Manhattan) The Laminated Shim Co. Inc., 47 West 34th St.—one 11 x 5 ft. tool room lathe, quick change gear with draw in chuck and collets.

N. Y., Rochester—G. Humbert, 304 Cornwall Bldg. (jeweler)—small drill press.

N. Y., Rochester—The Taylor Instrument Co., West Ave. and Ames St., C. D. Hart, Purch. Agt.—medium size lathe.

N. Y., Woodhaven — J. Pauzera, 4205 92d Ave., (plumber)—No. 300 A. Oster pipe threading and cutting off machine, capacity 1¼ in. to 2 in. Pipe complete with counter shaft.

Pa., Philadelphia — N. C. Rorke, 43 South 17th St., manufacturer of sheet metals—one 8 ft., one 4 ft. and one 10 ft. power brakes and one 36 in. squaring shear.

Ky., Owensboro—The Wright Machine Co. Inc., S. S. Wright, Purch. Agt.—24 in. heavy duty lathe, 14 ft. bed, quick changing gears, Leblond type preferred and a 1½ to 6 in. pipe cutting and threading machine, Landis preferred.

Va., Richmond — The Jefferson Garage, 5-7 West Main St.—electric drill, arbor drill and lathe.

Va., Richmond—The Natl. Auto Top Co., 810 West Main St., H. D. Cox, Purch. Agt.—machinery for making metal rollers and corner breaks.

Va., Richmond—The Walton Garage, 1207 and 1209 West Main St., L. L. Walton, Purch. Agt.—lathe and drill press.

W. Va., Weston—G. S. Kenner—equipment for proposed garage.

Ill., Annawan — The Bd. Educ., J. E. Moon, Pres. — manual training equipment for proposed school.

Ill., Carlinville—The Bd. Educ., C. J. Lumpkin, Pres.—manual training equipment for proposed school.

Ill., Chicago—E. A. Rotter, 220 Wisconsin St.—16 in. shaper.

Ill., Hartsburg—The Bd. Educ., H. Van Girpen, Secy.—manual training equipment for proposed high school here.

Ill., Manito—The Bd. Educ., F. Tollard, Secy.—manual training equipment for proposed school.

Ill., Pocahontas—The Bd. Educ., N. P. Nelson, Pres.—manual training equipment for proposed high school here.

Ill., Quincy—The Wiebner Machine Shop Co., A. Wiebner, Pres.—lathe, drill presses, etc.

Ill., Tallula—The Bd. Educ.—manual training equipment for proposed school.

Ind., Terre Haute—The Hossier Rolling Mills Co.—one key seater to key seat up to 2 in., one bolt cutter to thread bolts up to and including 2¼ in. diameter; one 18 in., 20 in. or 22 in. x 10 or 12 ft. lathe.

Ind., Terre Haute — The Terre Haute Auto Spring Co. — 2 new or used punch presses with thrust 10 in. to 12 in. deep, with bed at least 12 in wide, to take ⅞ in. holes through ¼ in. steel stock.

Mich., Detroit—The Gray Motor Co., Mack Ave.—miscellaneous machine shop equipment.

Mich., Detroit — The Street Ry. Comn., 320 Murphy Bldg., will receive bids until May 19 for 4 pneumatic tamping outfits complete, necessary tools and accessories. G. J. Finn, 710 Marquette Bldg., Comr. of Purchases and Supplies.

O., Cleveland—The Wheeling & Lake Erie R.R., Electric Bldg.—double head drill press with adjustable spindles for drilling splice bar holes in railroad rails.

O., Columbus—The Rogers Auto Sweeper Co., James Bldg., H. C. Rogers, Pres. and Mgr.—machinery for manufacturing sweepers and shop tools including drill press, grinders, cutters, lathes, presses, etc.

O., Sandusky—The Hinde & Dauch Paper Co., 401-419 West Water St. — general equipment for machine shop for paper plant at Ft. Madison, Ia.

Wis., Ft. Atkinson—The Bull Milking Machine Co., J. W. Meyer, Mgr.—2 engine lathes, one 24 in. shaper and a universal grinder.

Wis., Milwaukee—A. Kerner, 745 7th St. (machinist)—machine shop equipment.

Wis., Milwaukee—C. F. Stirnell, 336 21st Ave.—sheet metal working machinery.

Wis., Sheboygan — The Wald Mfg. Co., 18th St. and Martin Ave., (wire workers)—1 double head bolt cutter, 1 in. capacity, 1 tumbling barrel and 1 wire straightener ⅜ in. to ½ in.

Ia., Sioux City—The Bd. Educ., City Bldg., H. C. Roberts, Secy.—manual training equipment for the proposed 2 story, 120 x 230 ft. school.

Ia., Vinton—The Bd. Educ., M. E. Bickel, Secy.—manual training equipment.

Mo., Kansas City—The Standard Steel Wks., 1722 Tracy St.—additional machinery for manufacturing steel tanks, steel wagons beds and sheet metal work.

Mo., St. Louis—The Excelsior Laundry Co., Grand and Bell Sts., S. W. Burley, Secy.—lathe and drill press.

Mo., St. Louis—The Davie Motor Car Co., 1900 Washington St., A. F. Davie, Pres.—lathe and drill press.

Mo., St. Louis—The Missouri Car Co., Central Natl. Bank Bldg., 7th and Olive Sts., G. F. Weizel, Vice Pres.—general machinery and tools for the manufacture of electric railway cars.

Cal., Los Angeles—E. W. Smart, 1641 South Berendo St.—one small inclinable power press, 5 to 7 tons.

Que., Montreal—T. Rioux, Grant St.—repair equipment for garage.

Alaska, Ketchikan—The Supt. of Lighthouses will receive bids until June 6 for motor driven shaper and lathe.

Machinery Wanted

Conn., Middletown — The Forest City Laundry Co., 56-66 Hamlin St.—laundry equipment.

Mass., South Hadley—J. J. O'Toole, manufacturer of sash, doors, blinds and screens—1 shaper and 1 planer in good condition.

Ky., Auxier—The United Block Coal Co., W. White, Genl. Mgr.—coal mining machinery.

N. C., Charlotte — S. L. Williams, Box 962 (woodworker)—complete machinery to equip plant for cabinet work, including jointers, moulders, small planers, mortising machines, etc.

N. C., Kinston—The Chesterfield Mfg. Co.—complete machinery for the manufacture of rope.

N. C., Lincolnton — The Champion Tire Patch Co., M. M. Rudisill, Secy and Treas. —buffers and paste and labeling machines, etc.

N. C., Raleigh—The State College, W. C. Riddick, Pres.—laundry equipment.

Va., Richmond—Jerry Bros., 1823 East Main St., manufacturers of leather belting —scarfing machine, trimming machine, belt press, etc.

O., Columbus — The Franklin Adis Tile Co., Gugle Bldg., J. J. Morgan, Pres.— roller conveying machinery, tile making and track laying machinery.

Wis., Butternut—L. S. Barber & Son— saw mill machinery.

Wis., Milwaukee — The Natl. Paper Can Co., 576 Clinton Ct.—1 band saw.

Mo., Boonville—W. S. Mitchell—machines for the manufacture of tires.

Wis., Sparta—The Sparta Brush Co., J. C. Johnson, Purch. Agt.—special brush making machinery.

Okla., Enid—The Western Battery Mfg. & Supply Co., Inc., 224 West Bway., manufacturers of batteries and parts, etc.—wood-working machinery including machinery for sawing and grooving cedar and other timber, making separators used in storage batteries and machinery to make dove tailed battery boxes.

Okla., Okmulgee—The Okmulgee Brick Co.—equipment for making hollow building blocks and Spanish tile roofing, etc.

Ont., Haileyburg — H. S. Hennessy — $1,000,000 worth of equipment for proposed pulp mill.

Ont., Kingsville — W. T. Conklin — machinery and equipment for proposed sash and door factory and planing mill, on Erie St.

Ont., Southampton — The Panels Ltd. — $15,000 worth of special machinery and equipment for the manufacture of wood products.

Metal Working

NEW ENGLAND STATES

Conn., Collinsville — The Collins Co., manufacturer of edge tools, is having plans prepared for the construction of a 1 story steel rolling mill. Private plans.

Conn., Hartford—H. P. Townsend Mfg. Co., 10 Hoadley Pl., has awarded the contract for the construction of a 1 story, 70 x 75 ft. addition to factory for the manufacture of machinery on Chestnut St. Estimated cost, $20,000.

Conn., New Haven — A. Criscuolo, 22 Franklin St., has awarded the contract for the construction of a 1 story, 45 x 140 ft. garage on Wooster St. Estimated cost, $22,000.

Conn., New Haven—J. Heller, 33 Cottage St., has awarded the contract for the construction of a 1 story, 35 x 110 ft. garage on State St. Estimated cost, $15,000.

Conn., Plainville—The Plainville Casting Co. plans to build a 1 story foundry along the tracks of the New York, New Haven & Hartford R.R.

Me., Bangor — V. Hodgkins, Archt., 39 Hammond St., will soon award the contract for the construction of a 4 story, 100 x 130 ft. garage on Franklin St., for the Sweet-Mullen Co.

Mass., Dorchester — P. H. McCue, 29 Speedwell St., will soon award the contract for the construction of a 1 story, 100 x 180 ft. garage on Talbot Ave. Estimated cost, $60,000. S. S. Eisenberg, 46 Cornhill St., Boston, Archt.

Mass., New Bedford—LaBrode & Bullard, Archts., 251 Union St., will soon award the contract for the construction of a 1 story, 70 x 80 ft. garage on Emerson St., for F. W. Greene, Jr., 252 Union St. Estimated cost, $25,000. Noted Nov. 25.

Mass., Pittsfield—G. L. Hoskins, Cheshire, will build a 2 story, 50 x 75 ft. garage on South St., here. Estimated cost, $35,000. Noted Feb. 17.

Mass., Somerville — (Boston P. O.) A. E. Hughes, 5 Bow St., will soon award the contract for the construction of a 2 story, 52 x 70 ft. garage on Highland Ave. Estimated cost, $40,000. Private plans.

Mass., Springfield—W. Sacks, 47 Churchill St., is having plans prepared for the construction of a 2 story, 95 x 100 ft. garage, on Liberty and Sharon Sts. Estimated cost between $65,000 and $70,000. J. W. Foster, 38 Stockman St., Archt.

Mass., Springfield—The Winchester Sq. Realty Co., Winchester Sq., will build a 1 story, 70 x 150 ft. addition to its garage on Catherine St. Estimated cost, $30,000.

Mass., Westfield—A. Peck, Park Blk., will soon award the contract for the construction of a 1 story, 35 x 115 ft. garage. Estimated cost, $20,000. M. B. Harding, 33 Elm St., Archt.

Mass., Willimansett—S. Boisvert, Chicopee St., will soon award the contract for the construction of a 1 story, 30 x 90 ft. garage. Estimated cost, $15,000. Stuart & Tessier, 405 Main St., Springfield, Archts.

Mass., Worcester—H. Glick, 36 Portland St., will build a 1 story, 65 x 150 ft. addition to his garage. Estimated cost, $40,000. Noted April 21.

Mass., Worcester—The Worcester Buick Co., 799-803 Main St., has awarded the contract for the construction of a 1 and 2 story, sales room and service station, on Shrewsbury St. Estimated cost, $150,000. Noted March 31.

R. I., Newport—Booth & Nelson, West Bway., have awarded the contract for the construction of a 1 story, 50 x 50 ft. service station. Estimated cost, $10,000.

R. I., Providence—C. E. Brissette, 685 North Main St., has awarded the contract for the construction of a 1 story, 55 x 125 ft. garage and station, on Duncan and North Main Sts. Estimated cost, $30,000. Noted March 10.

R. I., Providence—Donnelly Taxi Motor Service, Inc., Chestnut St., plans to build a 1 story, 90 x 115 ft. garage and service station. Estimated cost, $40,000.

MIDDLE ATLANTIC STATES

N. Y., Buffalo—The Eberhart Steel Products Co., 828 East Ferry St., will build a 1 and 2 story, 100 x 100 ft. factory for the manufacture of steel products. Estimated cost, $40,000.

N. Y., Long Island City—The Duram Motor Co. of New York, 1764 Bway., New York City, is having plans prepared for altering its 8 story auto assembling plant, on Jackson Ave. and Honeywell St. Estimated cost, $200,000.

SOUTHERN STATES

N. C., Raleigh—The State College plans to build and equip a laundry and do general repair work to cost about $40,000, also construct a 2 story addition to its mechanical building, to cost, $100,000. W. C Riddick, Pres.

W. Va., Weston—Hood & Dent have had plans prepared for the construction of a 2 story, 70 x 150 ft. addition to their garage. Estimated cost, $30,000.

W. Va., Weston—G. S. Kenner will build a 2 story, 103 x 118 ft. garage. Estimated cost, $50,000.

MIDDLE WEST STATES

Ill., Chicago—C. Maerz, 29 East South Water St., is having plans prepared for the construction of a 1 story, 50 x 125 ft garage, on Shields and 26th Sts. Estimated cost, $25,000. R. C. Harris, 190 North State St., Archt.

Ill., Quincy—The Wiebner Machine Co. has awarded the contract for the construction of a 1 story, 60 x 90 ft. machine shop on 7th and York Sts. Estimated cost, $40,000

Ill., Rockford — The Petroleum Motor Corp., 220 South State St., Chicago, will soon award the contract for the construction of a 2 story, 270 x 720 ft. factory. Estimated cost, $2,000,000. R. C. Dale, Mgr. Arnold Co., 105 West Monroe St., Chicago, Archt.

Ind., Kokomo—The Worth Wire Wks. will soon award the contract for the construction of a 1 story, 60 x 100 ft. wire factory on Washington St. Estimated cost, $25,000. C. Ferriter, Kokomo, Archt. Noted March 24.

Ind., Lafayette—The Lafayette Tractor & Machinery Co. plans to build a 2 story machine shop and warehouse on 4th St. Estimated cost, $75,000. Riedel & Zink, Archts.

Ind., Rushville—The Dill Fdry. Co. plans to build a 1 story pattern shop. Estimated cost, $40,000. Private plans.

Mich., Detroit — The General Spring & Wire Co., 550 Marston St., will open bids about May 15 for the construction of a 1 story, 200 ft. x 250 ft. factory on Fort St. and Oakwood Blvd., here. Estimated cost, $200,000. E. D. Shank, 38 South Dearborn St., Chicago, Ill., Archt.

O., Canton—The Lewis Electric Co. plans to build a factory for the manufacture of safety switches. Estimated cost between $125,000 and $150,000.

O., Cleveland—H. L. Kollin and J. Roodman, 12001 Tuscora Ave., are having plans prepared for the construction of a 1 story, 50 x 90 ft. garage on East 140th St. and Lakeshore Blvd. Estimated cost, $40,000. M. Weis, 618 Union Bldg., Archt.

O., Warren—D. A. Miller will open bids May 18 for the construction of a 2 story, 80 x 120 ft. garage, on West Market St. Estimated cost between $60,000 and $75,000. R. J. Keich, West Reserve Bldg., Archt.

Wis., Appleton—A. Brandt Co., 987 College Ave., has awarded the contract for the construction of a 2 story, 80 x 158 ft. garage and repair shop on Superior St. Estimated cost, $45,000. Noted March 17.

Wis., Cudahy — J. Wagner, c/o Hotel Cudahy, has awarded the contract for the construction of a 1 story, 50 x 120 ft. garage, repair shop and show room, on Main St. Estimated cost, $75,000.

Wis., Ft. Atkinson — The Bull Milking Machine Co. will build a 1 story, 63 x 143 ft. factory on North Water St. for the manufacture of milking machines. Estimated cost, $50,000. J. W. Meyer, Mgr.

Wis., Ladysmith—R. J. Clark has awarded the contract for the construction of a 1 and 2 story, 66 x 100 ft. garage. Estimated cost, $45,000.

Wis., Manitowoc — The Globe Plating Wks. is having plans prepared for the construction of a 2 story, 75 x 150 ft. plating works factory on 8th St. Estimated cost, $75,000. M. Mrotek, Mgr. Private plans.

Wis., Milwaukee—The Nash Motors Co. Clement Ave. and Oklahoma St., is having plans prepared for the construction of a 3 story, 100 x 600 ft. auto body and sheet metal plant on Clement Ave. Estimated cost, $500,000.

Wis., Platteville—The Fiedler Motor Co., c/o E. C. Fiedler, Mgr., Mineral Point, will soon receive bids for the construction of a 1 story, 100 x 136 ft. garage, etc., on Water and Main Sts. Estimated cost, $75,000. H. Kleinhammer, Archt.

STATES WEST OF THE MISSISSIPPI

Ia., Davenport—G. A. Koester, Jr., 741 Perry St., has awarded the contract for the construction of a 3 story, 60 x 150 ft. auto sales building and garage, on Harrison and Scott Sts. Estimated cost, $100,000.

Minn., Minneapolis — The Kramer Motor Co., 1518 Hennepin Ave., is having plans prepared for the construction of a 2 story, 154 x 162 ft. garage. Estimated cost, $50,000. P. E. Crosier, 3725 Duport Ave. S., Archt.

Mo., North Kansas City—(Kansas City P. O.) The Standard Steel Wks., 1722 Tracy St., Kansas City, will soon award the contract for the construction of a 1 and 2 story, 118 x 226 ft. factory and office building. Estimated cost, $75,000.

Mo., St. Louis—The Davie Motor Car Co., 1900 Washington St., plans to build a 1 story garage and machine shop, on Hodiamont Alley east of Taylor St. Estimated cost, $40,000. A. F. Davie, Pres.

Mo., St. Louis—The Excelsior Laundry Co., Grand and Bell Sts., is having preliminary plans prepared for the construction of a 2 story, 80 x 135 ft. laundry and a 100 x 140 ft. power house, engine room and machine shop, on Grand and Washington Sts. Estimated cost, $200,000. L. Harger, 3844 Utah Pl., Archt.

Mo., St. Louis—The Walsh Motor Co., 4919 Delmar St., plans to build a 2 story garage and service station at 5135 Delmar St. Estimated cost, $75,000. W. D. Walsh, Pres.

Tex., Beaumont — The Beaumont Iron Wks. Co. has awarded the contract for the construction of a 1 story, 42 x 300 ft. machine shop. Estimated cost, $75,000.

CANADA

Ont., Chatham—The Weaver Mfg. Co., 2171 South 9th St., Springfield, Ill., has purchased a 2 acre site here and is having plans prepared for the construction of a factory for the manufacture of garage equipment. Estimated cost, $100,000.

Ont., Galt—R. Hall, Archt., Barrett Martin Bldg., will soon award the contract for the construction of a 2 story, 80 x 100 ft. garage on Wellington St., for Servis-Willard, Wellington St. Estimated cost, $25,000.

Ont., St. Thomas—The St. Thomas Metal Sign, Ltd., plans to purchase the old city power house and remodel and equip same for its own use. Estimated cost, $15,000.

Que., Montreal — T. Rioux, Grant St., plans to build an addition to his garage. Estimated cost, $10,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Middletown — The Forest City Laundry Co., 56-66 Hamlin St., is having plans prepared for the construction of a 1 story, 50 x 100 ft. laundry on William St. Estimated cost $20,000. W. D. Johnson Co., 174 Bond St., Hartford, Archt.

Conn., Stamford — The Stamford Candy Co., Main St., will soon award the contract for the construction of a 3 story, 40 x 80 ft. factory, on Beckley Ave. Estimated cost, $40,000 W. R. Steinmetz, 442 Atlantic Ave., Archt.

Me., Rumford—The Mt. Zircon Water Co., 103 Arch St., Boston, Mass., plans to build a bottling plant here. Estimated cost, $125,000.

Mass., Framingham—The Dennison Mfg. Co., 26 Franklin St., Boston, has awarded the contract for the construction of a 4 story, 70 x 100 ft. factory for the manufacture of tags. Estimated cost, $75,000. Noted March 10.

Mass., Leominster—The Union Novelty Co. plans to rebuild its woodworking plant on Whitney Ave., which was recently destroyed by fire. Estimated loss, $30,000. P. J. Gaudet, Pres. Private plans.

Mass., Salem—G. H. Fanning, Archt., 221 Essex St., will soon award the contract for the construction of a 2 story, 40 x 100 ft. shoe factory on Canal St., for the Michaud Shoe Co. Estimated cost, $20,000. Noted March 24.

Mass., Salisburg—W. H. Butler, Essex St., Haverhill, has awarded the contract for the construction of a 2 story, 45 x 150 ft. shoe factory, on Beach St., here. Estimated cost, between $35,000 and $40,000.

Mass., Worcester — The Grocers Bread Co., 306 Main St., has awarded the contract for the construction of a 2 story, 60 x 100 ft. bakery on Mann St. Estimated cost, $50,000. Noted April 28.

Mass., Wrentham — The Commonwealth of Massachusetts, Mental Diseases Comn., 109 State House, Boston, will soon receive bids for the construction of a 2 story, 35 x 105 ft. industrial building, at the State School, here. Estimated cost, $50,000. Kendall, Taylor & Co., 142 Berkeley St., Boston, Archts. and Engrs.

R. I., Pawtucket — The Automobile Journal Publishing Co., Exchange St., has awarded the contract for the construction of a 1 story, 40 x 160 ft. publishing plant on Montgomery St. Estimated cost, $60,000.

R. I., Providence — The Grocers Baking Co., North Main St., has awarded the contract for the construction of a 1 and 2 story, 28 x 97 ft. addition to its bakery. Estimated cost, $20,000. Noted March 31.

MIDDLE ATLANTIC STATES

N. J., Camden—The Pub. Service Gas Co., 418 Federal St., has asked the Pub. Utility Comn., for permission to issue $1,496,000 to construct a battery of ovens at its plant.

N. Y., Mt. Vernon—The Yonkers and Mt. Vernon Ice Corp., 29 South 11th Ave., is having plans prepared for the construction of a 100 x 130 ft. ice plant, on 13th Ave. and 3d St. Estimated cost, $100,000. J. Conte, Pres. Sibley & Featherston, 101 Park Ave., New York City, Archts. **T. J.** Bird, 103 Park Ave., New York City, Engr.

N. Y., New York—(Borough of Brooklyn) —The Empire Biscuit Co., 30 Waverly Ave., has awarded the contract for the construction of a 4 story, 50 x 100 ft. bakery on 3d and Waverly Aves.

Pa., Williamsport — The West Branch Silk Co., 800 Race St., has awarded the contract for the construction of a 2 story, 54 x 75 ft. factory on Race St. Estimated cost, $10,000.

SOUTHERN STATES

Fla. Ft. Pierce—The St. Lucie Ice Co. plans to build a new 50 ton unit, 2 story. H. Whyte, Pres.

N. C., Hamlet—The Carolina Pine Products Co. will build a factory for the manufacture of wood turpentine, tar, oil, etc. Estimated cost, $25,000. C. R. Poole, Pres.

Va., Richmond—Jerry Bros., 1823 East Main St., will receive bids until May 12 for the construction of a 3 story, 25 x 130 ft. factory, at 1902 East Main St., for the manufacture of leather belting. Estimated cost, $20,000.

MIDDLE WEST STATES

Ill., Chicago — Worthman & Steinbeck, Archts., 155 North Clark St., will soon award the contract for the construction of a 3 story, 75 x 135 ft. printing plant on Calumet Ave. and 20th St., for the Wartburg Publishing Co., 623 South Wabash Ave. Estimated cost, $125,000.

Ind., Ft. Branch—The Swinney Printing Co. plans to build a 1 story, 40 x 120 ft. printing plant. Estimated cost, $40,000. Anderson & Stingle, Evansville, Archts.

O., Bedford—The B. L. Marble Chair Co. has awarded the contract for the construction of a 3 story, 80 x 300 ft. factory. Estimated cost, $200,000. Noted March 31.

O., Cleveland—The Messinger Candy Co., 28 North State St., has had plans prepared for the construction of a 3 story, 44 x 112 ft. factory and warehouse, at 1213 Central Ave. Estimated cost, $75,000. C. Messinger, Pres. Robinnett, Bruyere & Cameron, Spitzer Bldg., Toledo, Archts.

Wis., Chippewa Falls — The Chippewa Falls Woolen Mills, 901 Prairie St., has awarded the contract for the construction of a 2 story, 62 x 130 ft. woolen mill. Estimated cost, $25,000.

Wis., Manitowoc—The Cereal Products Co., c/o F. Miller, Secy., 6th and Washington Aves., has awarded the contract for the construction of a 4 story, 60 x 210 ft. cereal factory. Estimated cost, $175,000.

Wis., Ripon—C. D. Storck, Mgr. of the Ripon Brewery, plans to build a 4 story, 50 x 140 ft. ice cream factory, on Main St. Estimated cost, $75,000.

Wis., Two Rivers—The Wisconsin Textile Mfg. Co., c/o G. C. Krist, Pres., has awarded the contract for the construction of a 1 story, 60 x 180 ft. factory on Main St. Estimated cost, $100,000. Noted April 14.

STATES WEST OF THE MISSISSIPPI

Ia., Fairfield—C. E. Moore, Pres. of the Albia Packing Plant, Albia, is representing a stock company which plans to build a packing plant here. Estimated cost, $75,000.

Ia., Ft. Madison — The Hinde Dauch Paper Co., 401-419 West Water St., has awarded the contract for the construction of a paper mill to include a 2 story, 45 x 130 ft. rotary building, a 4 story, 65 x 110 ft. heater building, a 2 story, 40 x 300 ft. machine shop, 120 x 220 ft. storage building and a 75 x 125 ft. power house. Estimated cost, $700,000.

Minn., Littlefork — The Universal Mfg. Co., plans to build a plant for the manufacture of ironing boards, clothes racks and other woodenware. Estimated cost, $100,000. C. P. Serenson, Secy. Engineer not announced.

Minn., Minneapolis — The Amer. Kersey Co. and Sherlock Merrill Co., 323 2d Ave., North, will soon award the contract for the construction of a 2 story, 48 x 144 ft. factory. Estimated cost, $40,000. Fallows, Huey & Macomber, 501 New York Life Bldg., Archts.

Minn., Minneapolis—The Hennepin Laundry Co., 8th St. and Hennepin Ave., is having plans prepared for the construction of a 2 story, 108 x 129 ft. laundry, on 4th Ave., and 17th St. Estimated cost, $75,000. I. W. Lawrence, Secy. H. A. Kennison, 411 Plymouth Bldg., Archt.

Mo., Boonville—W. S. Mitchell plans to build a 2 story tire factory. Estimated cost, $200,000.

Mo., St. Louis—The Boyd Welch Shoe Co., 4401 Cook Ave., has awarded the contract for the construction of a 3 story, 50 x 160 ft. shoe factory, on Cook and Newstead Aves. Estimated cost, $175,000.

Mo., Warrensburg—The Missouri Dairy Co., 1207 Locust St., Kansas City, plans to build a 2 story, 50 x 120 ft. milk bottling plant, here. Estimated cost, $150,000.

Okla., Okmulgee — The Okmulgee Brick Co. plans to build a plant for the manufacture of paving brick. Estimated cost, $200,000. R. E. Buckles, c/o owner, Engr.

Wyo., Douglas — The Western Alfalfa Milling Co., Denham Bldg., Denver, Col., plans to build an alfalfa mill here. Estimated cost between $10,000 and $15,000.

CANADA

B. C., Victoria—The Sidney Roofing & Paper Co., Sidney, plans to rebuild its 1 story roofing and paper factory, on Vancouver Island, near here, which was recently destroyed by fire. Estimated cost, $50,000. R. W. Mayhew, Mgr.

B. C., Victoria — The Victoria Gas Co., Store St., has awarded the contract for the construction of a gas making plant. Estimated cost $125,000.

Ont., Haileyburg—H. S. Hennessy is having plans prepared and will receive bids about June 15, for the construction of a pulp mill north of here. Estimated cost, $1,500,000.

Ont., Kingsville—W. T. Conklin plans to build a sash and door factory and planing mill on Erie St. Estimated cost, $60,000.

Ont., Kitchener—The Dumarts Ltd., Breithaupt St., has awarded the contract for the construction of a 4 story, 50 x 140 ft. meat packing house on Guelph St. Estimated cost, $100,000

Ont., Leamington—The Diamond Tobacco Co. plans to build additions to its plant. Estimated cost, $100,000

Ont., Ottawa—The Nukol Fuel Co., Ltd., 88 Bay St., Toronto, will have plans prepared for the construction of an artificial fuel factory here. Estimated cost, $250,000. A. Heffernan, Jackson Bldg., Mgr.

Ont., Toronto — Aked & Co. Ltd., 1067 Ossington Ave., has awarded the contract for the construction of a 2 story, 80 x 110 ft. woolen mill factory. Estimated cost, $100,000.